No. 1867 Vol. XLVI OCTOBER 5th, 1944

# FLIGHT

*and*

## AIRCRAFT ENGINEER

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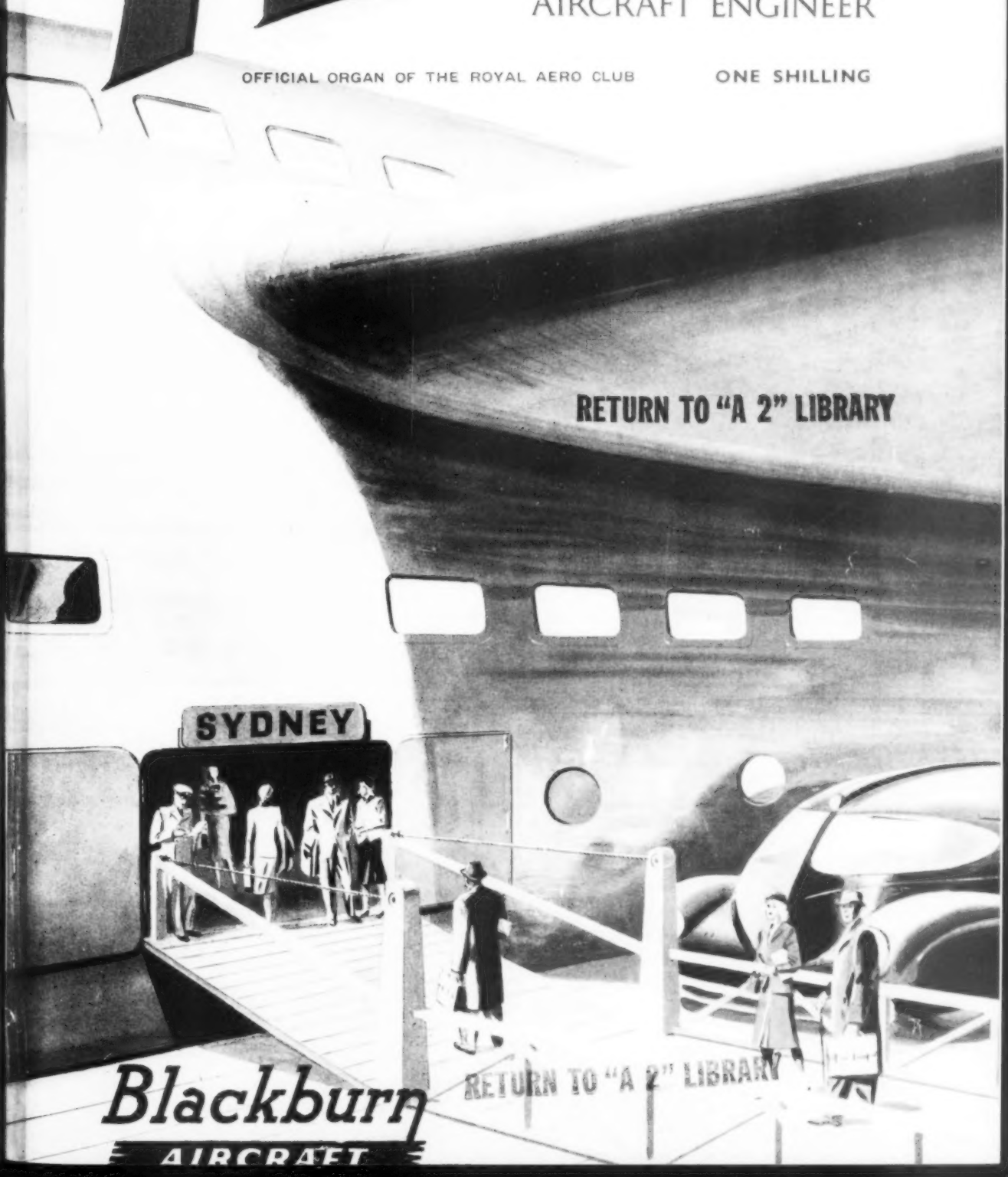

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538E

# 65

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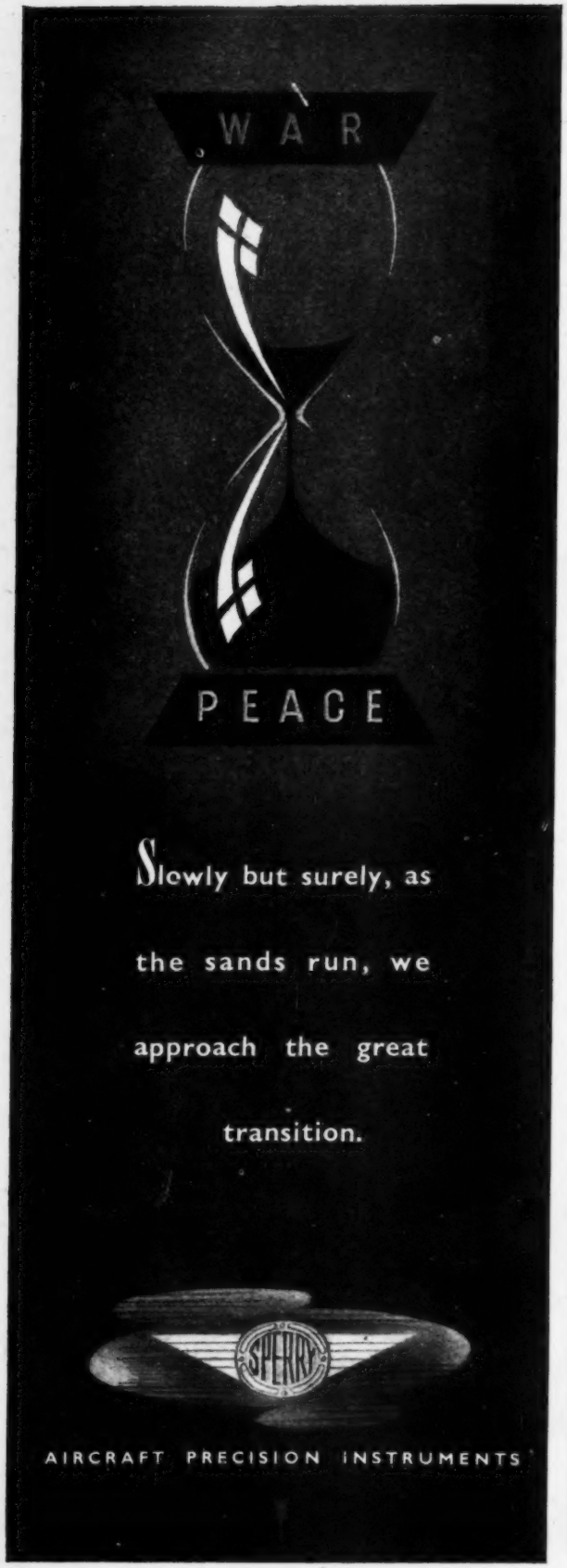


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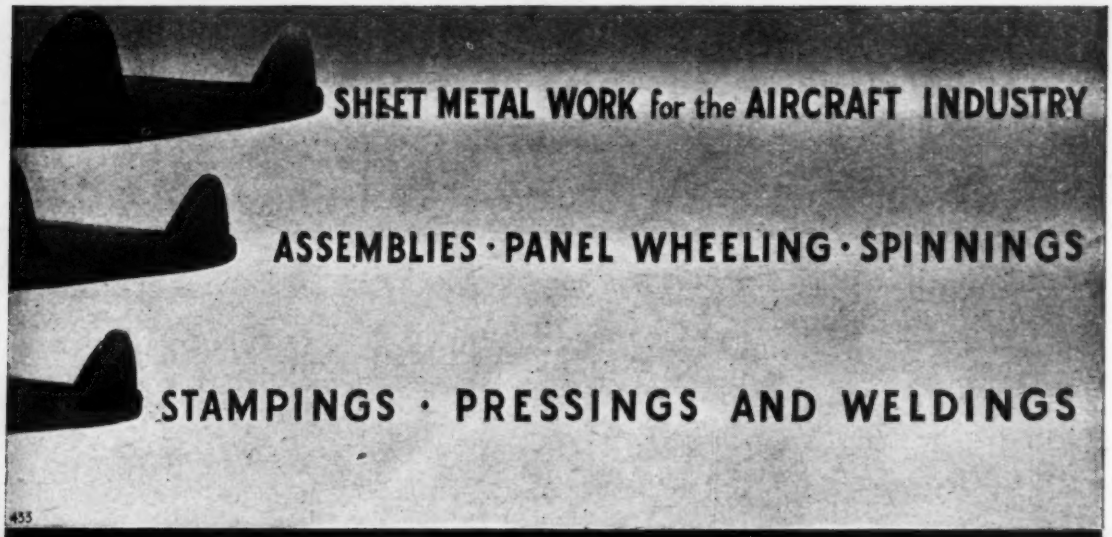
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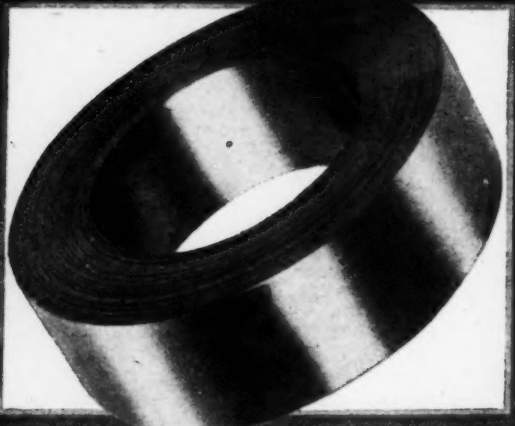

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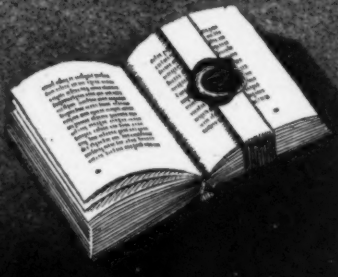

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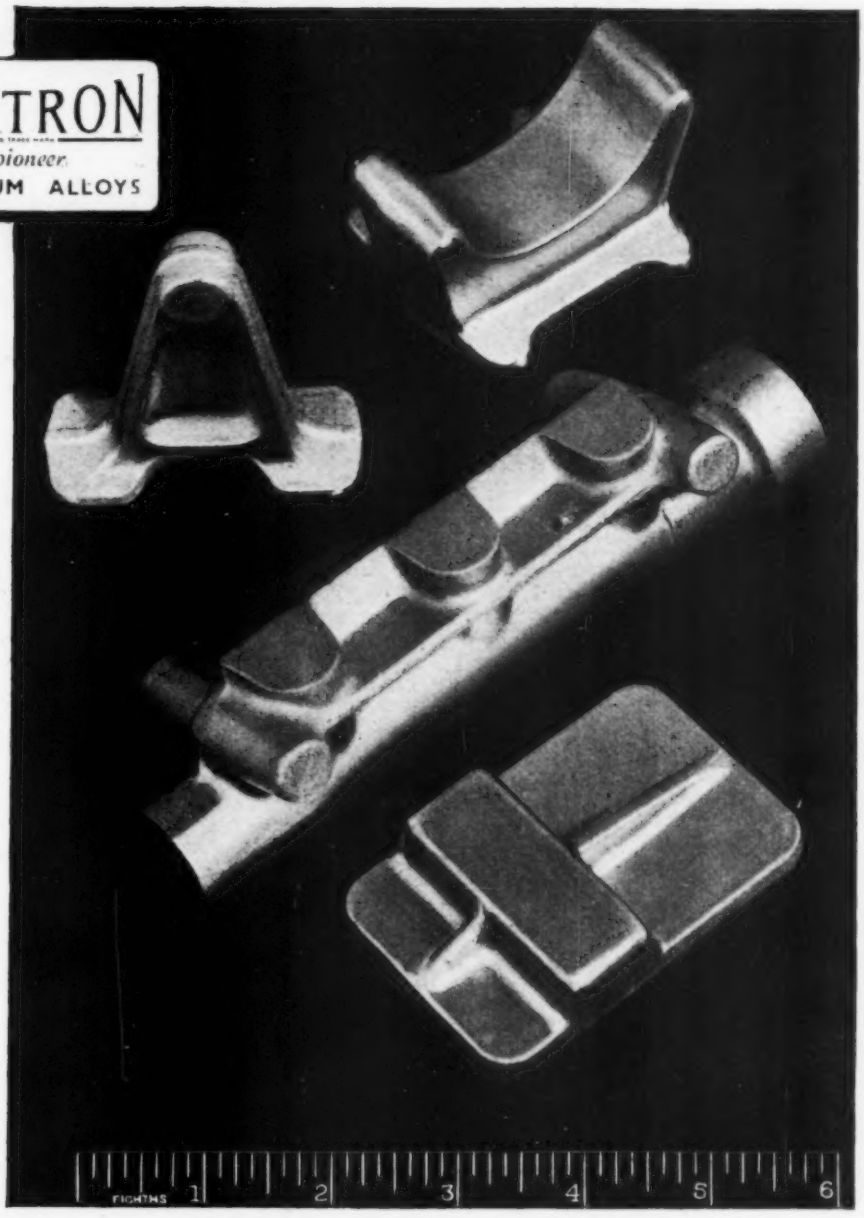


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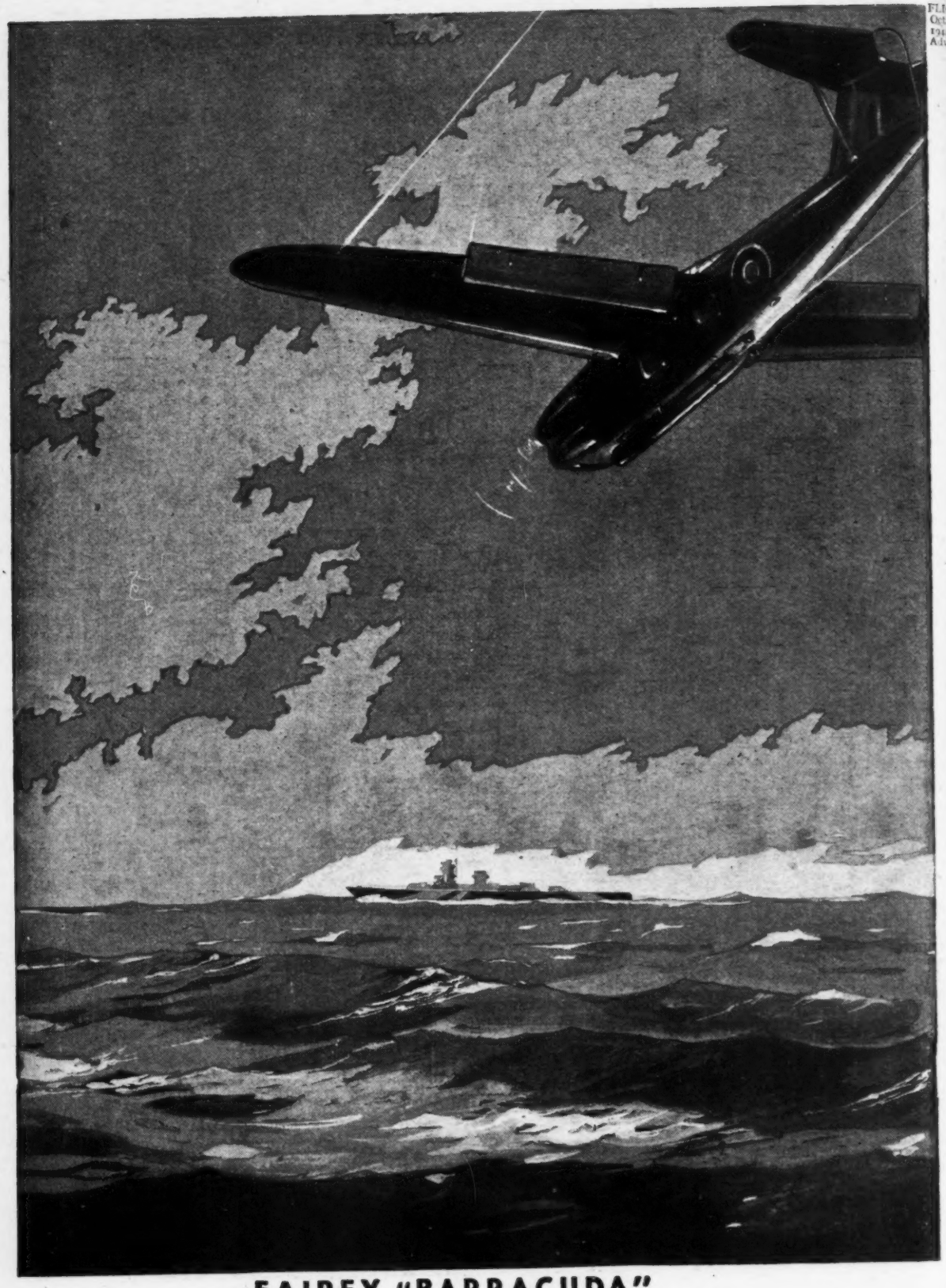

**FAIREY "BARRACUDA"**
(Rolls Royce "Merlin" engine)

FLIGHT
and
AIRCRAFT ENGINEER

FIRST AERONAUTICAL WEEKLY IN THE WORLD : FOUNDED 1909

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# The Outlook

## Private Flying

"THE primary consideration is the necessity for a sound, co-operative basic programme in which all those genuinely interested in the healthy expansion of private flying agree unselfishly to act as fanatical crusaders in the work of bringing aviation within reach of the ordinary man of moderate means and average intelligence." In that sentence is summed up Col. Fitzmaurice's faith in British development of private flying, professed in an article in this issue.

Not all will share the distinguished writer's views in detail, but few will fail to admire his enthusiasm. It will, indeed, require "fanatical crusaders" to persuade the powers that be to provide sufficient freedom from Government interference to make private flying appeal to the many, and yet to have enough supervision to protect not only the public on the ground but the pilots against themselves and one another.

Col. Fitzmaurice uses the example of the automobile industry. We have always held that private flying, at least as practised before the war, was more akin to yachting than to motoring, a view which we have frequently expressed. That need not necessarily always be so. Modern radio wonders may be developed in time to such an extent that the private owner-pilot will be relieved of the navigation of his machine, and will merely have to press a dashboard button on which is marked his desired destination. He may even be "touched-down" by the control officer when he arrives in thick weather at the other end and he may be warned of other aircraft in his vicinity. Such wonders are gradually becoming more than remote possibilities. But he still needs somewhere to land, and at the moment we are rather in the era, to resume Col. Fitzmaurice's example, of the man with the red flag in front of the car, and only inferior roads along which to drive.

Three things seem to be needed most of all before a real start can be made: sensible Government regulations; the co-operation of townships in laying down flight strips, etc.; and aircraft suitable for the private owner. To the first two Col. Fitzmaurice refers in his article. The third he dismisses with the somewhat airy remark that "it is as simple to learn to fly as it is to learn to drive a car." There we fear he rather forgets that he is himself a pilot of very long-standing, and that therefore to him the piloting of an aircraft is simplicity itself. We suggest that before the statement is true it will be necessary to modify our ideas of what the beginner wants.

At a guess we should say that, first and foremost, a perfectly harmonised two-control system is essential. The co-ordination of three control movements is the very reverse of being instinctive, and the aim should be to come as close as possible to the controls of a car. It seems obvious that some form of tricycle undercarriage will be needed, possibly combined with the Maclaren principle of controlled castering so that out-of-wind landings can be made on single-strip municipal airfields.

## Arnhem

THE withdrawal of most of the survivors of the airborne contingent from Arnhem took place just before our last issue was published, and is therefore no longer "hot news." But events such as this always have a moral, and that moral may well be discussed for ages yet to come.

It was quite right from every point of view for newspapers and the B.B.C. to stress and praise the gallantry and endurance of the men, and to point out that in spirit the survivors were unbeaten soldiers. Few, if any, feats of arms in this war, or any other war, have

equalled the heroism of those airborne troops; though there have been many occasions when British troops (and soldiers of other nations, too) have fought to the last gasp, refusing to surrender or retreat. Often the result has been the annihilation of the whole body.

It is, however, vain to deny the fact that this incident was a British failure, or; if the blunt truth is preferred, a defeat. Out of some 7,000 troops (perhaps more) only about 2,000 were evacuated across the Lek branch of the Rhine Hard though they fought, they did not succeed in securing the bridge at Arnhem for the use of the Allies On the other hand, the Prime Minister has confirmed the claim that their fight made possible the seizure by the 2nd Army and the other two airborne divisions of the bridge over the Waal at Nijmegen. Bad weather certainly deprived the men of full air support. In our chagrin at the Arnhem set-back we need not forget that the landings at Eindhoven and Nijmegen fully achieved their objects, and enabled the 2nd Army to get across the Waal.

If the Arnhem fight really secured the Nijmegen bridge, then the sacrifice of some 5,000 men may have been justifiable—or perhaps we should say justified. To win a war as quickly as possible almost invariably saves lives, and a sacrifice of brave men at some critical spot is often economical of total lives lost. This airborne landing was a gamble, and Generals who never gamble with fate rarely shine as stars. The only question was whether this particular part of the gamble was likely to gain more in the event of success than it stood to lose in the event of failure. It seems that this question must be answered in the affirmative.

## Guarding the Hump Line

THE knighthoods conferred on General Slim and his divisional commanders is a proof of how highly the campaigning of the 14th Army is appreciated at headquarters in London. The same Army also received a handsome testimonial from the Prime Minister last week in the House of Commons.

The Prime Minister was concerned to set matters in their true light as a result of some distorted reports which had appeared in American newspapers. The aggressive fighting of the 14th Army had, said Mr. Churchill, two results. The order in which he placed the two was worthy of note, though that does not mean necessarily that he ranked the importance of the first much higher than that of the second.

Mr. Churchill first spoke of the air route to China which is flown by an American Command over the Himalayas (known locally as the Hump) into China, by which much more material (the Prime Minister would not say how much more) was sent into China than had ever been carried by the Burma Road in its palmiest days. The aggressive campaign of the 14th Army (which is still being carried on despite the monsoon) "guarded the pass of the American air line to China." Mr. Churchill then added that the campaign had protected India against the horrors of a Japanese invasion.

This speech shows that at least one major object of the fighting in Burma during the last few months has been to protect an air line, and by doing so to ensure the delivery of supplies to Generalissimo Chiang Kai-shek. It is an episode almost unique in warfare. The Libyan campaigns, from Egypt to Tunisia and Sicily, were fought to free for Allied use the passage of the Mediterranean—a sea line. That was easily comprehensible by any Briton. To fight for an air line is a new thing; but, now that the situation has been made clear, all Britons will approve of making every effort to send the maximum possible help to the Chinese.

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**PREPARING FOR DISSECTION:** This flying bomb was still-born and its internal organs fairly intact. An illustrated article appears on pp. 364–367 of this issue.

# WAR in the AIR

## The Arnhem Evacuation : Luftwaffe's Spasmodic Appearances : Activities of Heavy Bombers

A ship blows up during an attack, by Seafires and Avengers from H.M.S. *Furious* and *Trumpeter*, on a German convoy off Norway.

THE loss of some 5,000 men, mostly of the 1st Airborne Army, and the withdrawal of about 2,000 exhausted survivors to the southern bank of the Lek branch of the Rhine caused grief and disappointment in Britain, in which Holland obviously and outspokenly shared. This set-back means that various branches of the Rhine still lie in front of Gen. Eisenhower's armies, that Holland has not yet been completely liberated, and that the way into the plains of Germany does not yet lie open.

But great successes have been gained, and on the whole the Battle of Holland has been going well. Some German forces which were stationed in the coastal areas were given a new chance of escaping into Germany, whereas they might have been cut off and "liquidated" if the airborne effort had been a complete success. That does not apply to the garrisons of the Channel ports, which were ordered to hold out to the last.

The Canadians steadily advanced round Calais, and Bomber Command paid several visits there, and unloaded heavy weights of bombs on the fortifications.

The occasional appearances of the *Luftwaffe* are interesting, chiefly because they are so rare. During the battles to link up with the airborne troops, about 100 German aircraft made an attack on the bridge over the Waal at Nijmegen, and succeeded in hitting it. They did not, however, destroy it, and it remained usable. In the meantime an airfield had been established in what was called the corridor, up which the supply columns were rushing to the branches of the Rhine, and, of course, fighters were the first Allied aircraft to take up their residence on it. So the German bombers did not have things all their own way, and their losses were not light. Any loss in the air is now a serious matter for the Germans; but an Air Force which does not venture to bomb or to fight is not a very valuable asset. No doubt the German fighters are being conserved for some special occasion, and they still resist some of the Allied bombing raids with a degree of spirit, but they never seem to achieve much. Specific figures are not published, but one inclines to the belief that nowadays Allied air losses are mainly due to *flak*. A few months ago *flak* was considered far less damaging than defence by fighters.

Mustangs and Thunderbolts have been bombing the fortifications of the

**CEILING DOWN : The effect of one of our big armour-piercing bombs on the 12ft thick ferro-concrete roof of the submarine pens at Brest.**

## WAR IN THE AIR

forts round Metz, which are being besieged by the Americans. Fighters now carry a much heavier load of bombs than they were able to do a short time ago, but still one would like to hear of the heavy bombers taking a hand. That may happen soon, but the Channel ports have prior claim, and at the same time the bomber offensive against production is being maintained. Panther tanks have been found abandoned on the battlefields in the West, and marks on them showed that they had recently been delivered from some factory straight to the front. That was a good sign, for it is evidence that the Germans are feeling their losses, and that the reserve depots are not able to supply the front in all cases. It therefore gives a good reason for bombing tank factories.

A new fighting formation has recently been in the news. It is called "Land Forces, Adriatic," and it works with the Balkan Air Force, as well as with the naval units in the Adriatic. There have been airborne and seaborne landings on the islands off the Dalmatian coast and in Albania.

### Forcing the *Luftwaffe*

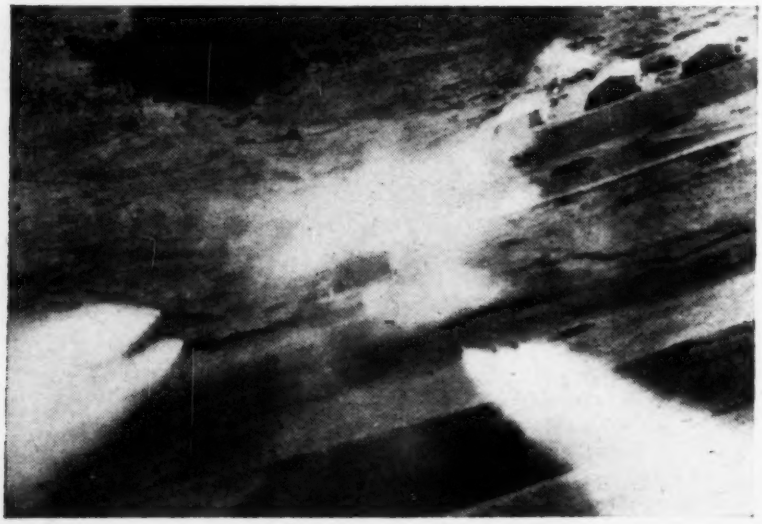
TOWARDS the end of last week more than 1,000 Fortresses and Liberators made an attack one day on war industries in central Germany. That is the sort of operation which forces the *Luftwaffe* to send into action its dwindling body of fighters. But the air defence had to adapt itself to the new conditions. The German fighters did not attempt an all-out attack on the American bombers and their escort. They concentrated their efforts on small elements of the bomber force, and they and the A.A. guns between them succeeded in bringing down 49 bombers and 12 fighters. Some of the missing fighters are believed to have landed in friendly territory. The American escort destroyed 26 of the German fighters, while the bombers shot down 10 more. It was a stiff fight.

The mere tale of losses on both sides would suggest that the Germans had the best of it; but the success of a bombing raid is not to be measured in that way. The American Army can afford such losses far better than the Germans can afford to lose so many fighters—even though some of the German fighter pilots may have got down alive on friendly soil. In addition one must reckon the damage done by the bombs, which may well have exceeded in war value the American losses in machines.

**NOSE HEAVY: A ME 109 left on the airport at Antwerp which is now in Allied hands.**

The Germans are believed to have been left with 60,000 troops of first line quality and some 40,000 garrison troops of inferior quality on the west side of the Nijmegen corridor, and their success in averting the threat of isolation which was represented by the presence of the 1st Airborne Division at Arnhem has, for the moment, left them with a comparatively free hand. Nevertheless, they showed distinct nervousness about the extension of the Allied corridor towards the west, and more air support was provided for their own forces on that side. A certain number of jet-propelled aircraft were noticed in the enemy formations, but no suggestion has come from the front that these machines have made any difference to Allied air supremacy. On the whole, the more we can force the Germans to fight in the air, the better it is for Allied prospects.

There has also been some German air opposition to the Allied fighters and fighter-bombers which attacked gun positions and strong points in the area of Nijmegen and Arnhem and strafed road and railway transport behind the enemy lines in Holland. Many combats ensued, and the advantage lay steadily with the Allied aircraft.



**FIREWORK DISPLAY: Rockets, from a South African Beaufighter of the Balkan Air Force, streak towards German barracks at Prenjosé, Albania.**

### Into Germany

DESPITE all difficulties and setbacks, both British and American troops have crossed the frontier into Germany. That was never done in the last world war, at least on the Western front, and subsequent events showed that it was a great pity that the Allies did not advance and occupy Berlin, even though Hindenburg and Ludendorf had compelled the German Government to sue for an Armistice. It was bad business to leave the German people without ocular proof of the defeat of their army.

In this war many German manufac-

## WAR IN THE AIR

turing cities have been devastated by Allied bombing, and probably many Germans remember that Göring had promised them that that could never happen. But there has been air damage in British cities also, and one must remember the cleverness of German propagandists, like Göbbels, and the readiness of the German people to believe fairy tales which flatter their vanity. The growing generation may easily be persuaded that the *Luftwaffe* did more harm to Britain than the Allies did to the Ruhr and other parts of Germany. As a nation, they are Army-minded rather than air-minded, and to see Allied troops on German soil will be to them the best proof that Germany has been defeated. Undoubtedly Berlin will be occupied in due course, but a fighting invasion of Germany will leave an indelible impression on the minds of the people.

The week-end saw the final capture of Calais and also the capture of the guns at Cap Gris Nez, which for four years past had been fairly constantly shelling Dover and Folkestone. The R.A.F. played a great part in the reduction of Calais. Its heavy bombing was mentioned above in this article. Then an armistice for 24 hours was granted to the garrison to permit the evacuation of the civilians—rather a different story from that told by Rodin's sculpture of the treatment of Calais citizens by King Edward III—and when this was over the Canadian guns and the R.A.F. opened out with full vigour on the German fortifications. The R.A.F. sent over medium bombers and rocket-firing Typhoons. The Canadian troops followed up hard.

**THE BIG STICK : Halifaxes of Bomber Command discouraging German garrison troops in Calais from regarding the town as a health resort.**

and by the evening all organised resistance had ceased, and the German commander was a prisoner of war.

The Gris Nez guns are not an air story, except in so far as their concrete covering had proved bomb-proof, but the end of the ordeal of the Kentish towns was a matter for national rejoicing.

In the fighting in Holland the Allied Air Force had met increasing numbers of the jet-propelled Me 262, known as the Swallow, which is very fast, but up to the moment of writing has not shot down a British or American fighter. It has been mostly used as a fighter-bomber, and has usually been escorted by Fw 190s. The rocket-propelled Me 163 has been used only as a defensive fighter. The German pilots seem to find difficulty in manœuvring both these types. On the other hand, squadrons of Tempests, now no longer required for defence against the air torpedoes, have appeared over the front.

Night-fighters have been destroying many German aircraft over the Ægean. The victims were probably trying to evacuate officers.

**OUT OF ITS INFANCY : The first British jet-propelled aircraft which first flew as long ago as May 15th, 1941. The jet power unit was designed by Group Capt. (now Air Commodore) Whittle and built by Power Jets Ltd. Design and construction of the airframe was by the Gloster Aircraft Co. Ltd., and their chief test pilot, the late Flt.-Lt. P. E. G. Sayer, carried out all the original flying tests.**

# HERE AND THERE

## R.Ae.S. Honour for Whittle

THE council of the Royal Aeronautical Society has awarded the Society's Gold Medal to Air Comdre. F. Whittle, C.B.E., F.R.Ae.S., for his work on jet propulsion. This is the highest honour which the R.Ae.S. can bestow, and only nine awards had previously been made: In 1909, Wilbur and Orville Wright; in 1910, Chanute; in 1915, Professor Bryan and E. T. Busk; in 1926, Dr. Lanchester; in 1927, Professor Prandtl; in 1933, Sir R. Glazebrook; in 1933, Señor de la Cierva.

## More American Air Plans

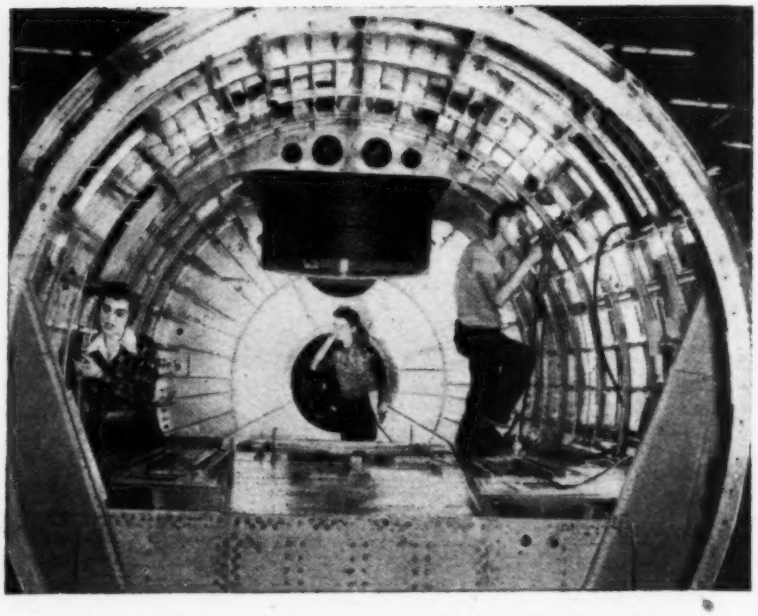
FLIGHTS twice a day from Los Angeles and San Francisco to Hawaii by land planes carrying 128 passengers each are planned by Pan-American Airways. The company expects 100,000 passengers a year, it is stated.

The U.S. Department of Commerce has also announced that studies are under way for the development of cargo aircraft to ply between the U.S. and Latin American countries.

It was added that the flow of trade between the two continents was expected to increase after the war.

## Fair Winds

A CANADIAN-BUILT Lancaster of the R.A.F. Transport Command recently established a record for a non-stop distance flight of 1,500 miles from Nassau, Bahamas, to Dorval Airport, Montreal, in 5 hr. and 35 min. The aircraft flew strictly according to flight plan over the North American Continent, and never exceeded the normal long-range cruising speed.



**PRESSURE TO BEAR ON JAPAN: Looking in at the nose of a B-29's pressurised control cabin, under construction at the Boeing plant at Renton (Wash.), one of three now on mass production.**

## American Comment

REFERRING to the Airacobra, supplied in considerable numbers to the Red Air Force, the U.S. journal, *Business Week*, adds, "It is common knowledge that, after accepting delivery, the Soviets stripped the P-39 Airacobra of armour and just about everything that would come off in order to increase speed, ceiling, and manœuvrability."

**CHIEFTAINS CONFER: From left to right, Admiral Sir Bruce Frazer, now C.-in-C. Eastern Fleet; Air Marshal A. Durston, A.O.C., Ceylon; and Admiral Lord Louis Mountbatten, Supreme Allied Commander, S.E. Asia. The meeting, attended also by Gen. Stilwell, the U.S. Commander in North Burma, took place in Ceylon.**

## Commons Interlude

MR. DUGDALE (Lab., West Bromwich) asked the Minister of Aircraft Production in the House last week why the request of the Mayor of West Bromwich for the loan of an aircraft to be exhibited at the Red Cross fair held at West Bromwich on August Bank Holiday was refused.

Sir Stafford Cripps said a request was received for the loan of an aircraft for one day. This could only have been met by the diversion of an aircraft from the production line. It was decided that this diversion for so short a period was not warranted.

Mr. Dugdale then asked why one fighter and three troop-carrying planes were diverted to a fête held under the auspices of the Regional Commissioner, known as Lady Dudley's Red Cross Fête, opened by Mrs. Winston Churchill shortly before?

Sir Stafford: "Perhaps you will put that question down."

## Cause . . . .

LORD BRABAZON said at Wallasey (Cheshire) last week that we had given America two years' advantage in the design and study of aircraft which could easily be turned to civil purposes. For in the aviation field, when the war ended, America would have first-class machines and we would have only converted bombers.

"That has been a mistake, and I hope that the Air Staff will devote a little more energy and enthusiasm to this question. . . . We are going to have another crack at them" in the House of Lords in a week or two."

## . . . . And Effect

MR. ARTHUR DRAKEFORD, the Australian Air Minister, told the House of Representatives last week that the Government had authorised the im-

## HERE AND THERE

portation of a limited number of aircraft from America for internal aviation. Australian National Airways were purchasing them; not the Government.

Mr. Drakeford denied that the Commonwealth was favouring American aircraft in preference to British. The managing director of A.N.A. had stated that he could only purchase American types, but this was not an indication that British aircraft would not be bought when available.

Britain was producing only the York, which Mr. Drakeford said was not basically designed for transport. It had always been understood that at the end of the war the British Commonwealth nations would get suitable civil aircraft from the U.S. if supplies were not available from the Empire.

### Government Flies Home

THE Prime Minister of Luxembourg and three other members of the Luxembourg Government were flown to Paris last week in an aircraft of R.A.F. Transport Command on the first stage of their return to their country following its liberation.

In addition to the Prime Minister (M. Dupong), the party consisted of M. Krier, Minister of Labour, M. Bodson, Minister of Justice, and M. Beck, Minister of Finance.

### P.o.W.'s Considered Last

ALTHOUGH arrangements had been made by the Red Cross for taking parcels to British prisoners of war in Germany on the *Lufthansa* aircraft flying between that country and Lisbon, they have been cancelled on the grounds that the service "leaves no margin for this purpose."

As a result, 15 tons of medicine, biscuits, condensed milk and tobacco which have accumulated at Lisbon had to be sent back to England by air.

**PROUD MOMENT: Officer-cadet, J. W. C. Warner, of Peckham, London, receiving the "Best Cadet" medal from Air Marshal Sir Arthur Barratt after the passing-out parade of R.A.F. Regiment cadets in the Midlands.**

The German Air Attaché, supported by four other members of the Legation, are reported to have been on the Lisbon airport last week to welcome three Germans (identity not stated) who arrived from Germany last week, having flown across France to Spain and Portugal.

Shortly afterwards the *Lufthansa* four-engined aircraft left for Germany with seven passengers.

### New T.C.A. Route

AN air route from Canada to New Zealand and Australia is being considered by the Canadian Government, to be operated by Trans-Canada Airlines or a subsidiary company of the Government-owned air transport concern, according to a statement in the Canadian House of Commons at Ottawa by the Minister of Munitions and Supply, Mr. C. D. Howe.

### A Jet to Catch a Jet

THE statement (we hesitate to call it news) was officially released last week that British jet-propelled fighter aircraft have been in action against flying bombs and were employed with success, most valuable experience having been gained.

The Air Correspondent of a daily newspaper goes on to add: "It may be assumed that the Allied jet fighter is a twin-engined affair similar in conception to the Me 262. It is called the Squirt, and is particularly manœuvrable and very fast."

### Not Entirely Forgotten

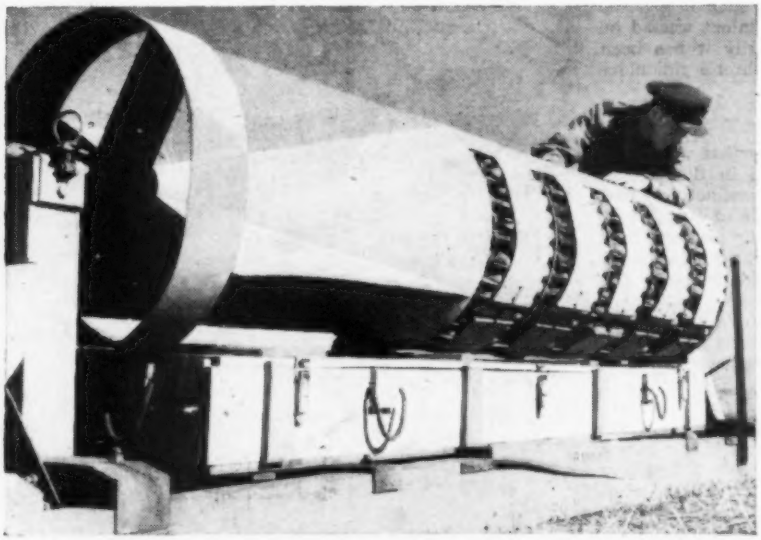
MEN in the R.A.F. West Africa Command call West Africa the "forgotten front," but one thing they do not grumble about is their mail. In a Sahara hut you can read a London newspaper only two days old.

On an average, 86,000 air letters a month are received for airmen in West Africa. No air letter takes more than 10 days to reach any destination in West Africa. The average is about a week.

### Parliamentary Viewpoint

MR. RONALD TREE, M.P., addressing his Market Harborough constituents in Leicester recently, said: "If we are not careful we are going to be a bad third in civil aviation.

"When Capt. Harold Balfour in the House of Commons recently said that all was well with civil aviation, wool was being pulled over the eyes of the country, and when he said we would catch up and that the aircraft we have in design, to be ready in 1949, will be ahead of the United States, he was making a mistake, as they are out of date now."



**LATENT HEAT: This multiple incendiary bomb, all ready for use, was found on a German airfield near Brussels when the advancing Allies captured it. The swiftness of the advance gave the Hun no time to destroy this and other equipment.**

| | |
|---|---|
| Overall length | 25.375ft. |
| Length of fuselage | 21.5ft. |
| Maximum diameter of fuselage | 2.7ft. |
| Length of power unit | 11.25ft. |
| Maximum diameter of power unit | 1.9ft. |
| Wing span | 17.67ft. |
| Wing chord | 3.42ft. |
| Wing area | 51 sq. ft. |
| Wing loading | 93 lb./sq. ft. |
| All-up weight | 4,750 lb. |
| Speed (approximately) | 360 m.p.h. |
| Stalling speed | 150 m.p.h. |
| Thrust at 360 m.p.h. | 600 lb. |
| Thrust h.p. at 360 m.p.h. | 575 |
| Power loading | 8.25 lb./thrust h.p. |
| Aspect ratio | 5 |

# Wasted

## *Clever Features of the Flying Bomb, V.1.: Simple but Control Mechanism Expensive : Aim Det*

**Description by W. S. SHACKLETON**

THAT the flying bomb was a weapon of negligible strategic importance became obvious after the first few weeks of the attacks. That it contained some very clever mechanical contrivances was suspected from the way in which the percentage that reached London performed. We have previously told our readers of our fruitless endeavours to obtain permission to examine one of these bombs, and of the curious working of the Official Mind which placed difficulties in the way. Last week M.A.P. suddenly decided that one could be inspected, and invited some 30 press representatives to examine it, including some Fleet Street photographers who, in their usual way, could not think up anything more brilliant than to photograph a pretty girl sitting astride the contraption, a picture singularly useless to the serious student of the machine's technical features.

Fortunately we were permitted to send Mr. M. A. Millar who did wonders in the very limited time available, as the sketches will indicate. To Mr. W. S. Shackleton we entrusted the task of describing the machine. He, too, was at a disadvantage in that he could not obtain a pass for "Horace, his fame stressman." Any shortcomings that may be discovered in the article should, therefore, be put down to the absence of "Horace." We hand over to Mr. Shackleton.

We have now seen and examined a flying bomb. We saw it along with twenty-seven others and there was not much room to move around the machine. It is a brilliant technical achievement and it bristles with the cleverest of ideas. One feels, however, when examining it and realising the purpose for which it was designed and the use to which it has been put, that it is the product of a collection of insane professors. Never before was such a gigantic volume of real engineering and scientific talent wasted on such an effort. We imagine that militarily it has been about as useful to Germany as the Fuehrer's ridiculous moustache.

### Four Years' Development

Before describing the machine let us say that we do not believe this machine has been developed in the last 12 months as is generally supposed. We feel instinctively that the idea of this thing dates from the Battle of Britain!

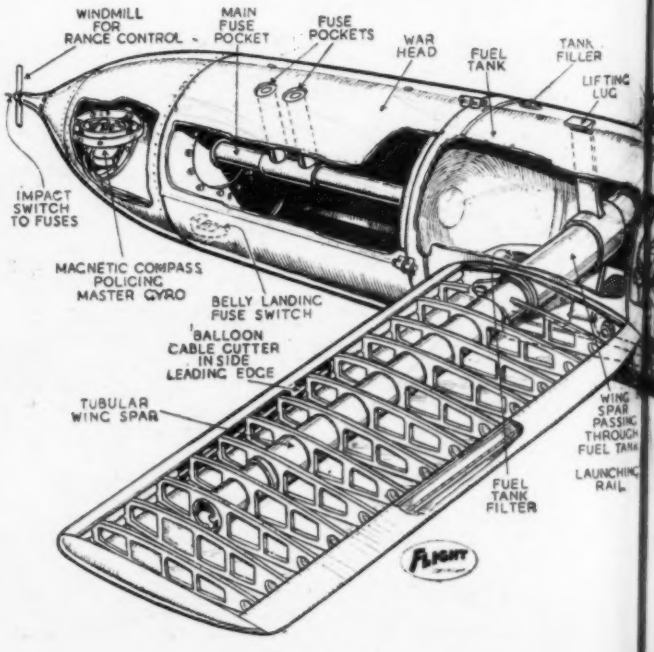
The German flying bomb is a simple little aircraft, built almost entirely of welded mild-steel plate, and driven by the simplest form of jet-reaction engine yet devised. The machine we saw had a parallel wing of 3ft. 5in. chord, with a span of 17ft. 8in. It seems probable that this is essentially the basic type used by the Germans throughout. We have been unable to find any real evidence of big-span versions with tapered or elliptical wings. The one with the butterfly wings is the mirage of some inebriated spotter! It would be both expensive and inefficient. The whole design of V.1. is of the simplest and cheapest kind. It is a real mass-production job. Nevertheless, we do not believe the figures which we have heard as to its probable cost. We have had estimates from responsible people that these machines can be produced for as little as £20 each! Others have ventured a figure of £200 or as much as £400. Quite frankly, we do not believe that this machine, taking, of course, its development, design and tooling costs into account, has been built for much less than £2,000. There are hundreds of pounds worth of material, labour and overheads per machine in the compass, automatic pilot, servo motors and electrical gear alone.

The thing that strikes one when looking at a general-arrangement drawing of this aircraft is, first, the high thrust line and, secondly, the great mass of weight aft, due to the rearward placing of the jet-propulsion engine. The machine must have a very high longitudinal moment of inertia. When the engine stops, a nose-up pitching moment of considerable magnitude would be produced. It is evident, however, that these moments can easily be countered by the automatic pilot through the elevator control. Another thing is the absence of ailerons. Obviously the guiding principle here was to cheapen and simplify the machine.

What happens appears to be something like this: the axis of the master gyro is elevated some 25 deg. to the horizontal in a vertical plane so that a roll appears to the auto-pilot as a reduced amount of yaw. Hence if the left wing should drop, it puts on right rudder, steering to the right and giving a higher velocity over the left wing, thus raising it to the normal position.

We noticed, too, that the single lifting lug was well in front—indeed some 6 inches—of the main wing spar and of the probable centre of gravity of the aircraft. This puzzled us a bit at the time, but the probable explanation is that when hoisting at this lifting lug, the machine will take a tail-down attitude, probably corresponding with the angle required on the launching platform.

We could not help speculating as to the identity of the designers who evolved this machine. Obviously a gigantic



# Talent

## ...mple Construction Facilitates Manufacture, ... Determined by Air Log and Compass

*Drawings by M. A. MILLAR*

team of aircraft and engine specialists took part. There would indeed be teams of experts on aerodynamics, metals and structures; specialists on automatic pilots, gyroscopes, bombs, instruments and electrics. No doubt the designers responsible for the development of the jet-propulsion unit were told to develop an engine giving a certain thrust at a certain velocity with a specified fuel consumption, and fairly close weight limits. The unique positioning of the power unit would enable errors of weight in the completed unit to be catered for by mounting it forward or aft of the position assumed in the initial design. For instance, had the power unit turned out to be heavier than anticipated, it might have been mounted a little forward to bring the c.g. to the desired place. On the other hand, as the wing mounting is of such simple form, consisting merely of a large-diameter steel tube passing through the petrol tank, this also might have been moved a little fore and aft when all the precise component weights had been ascertained.

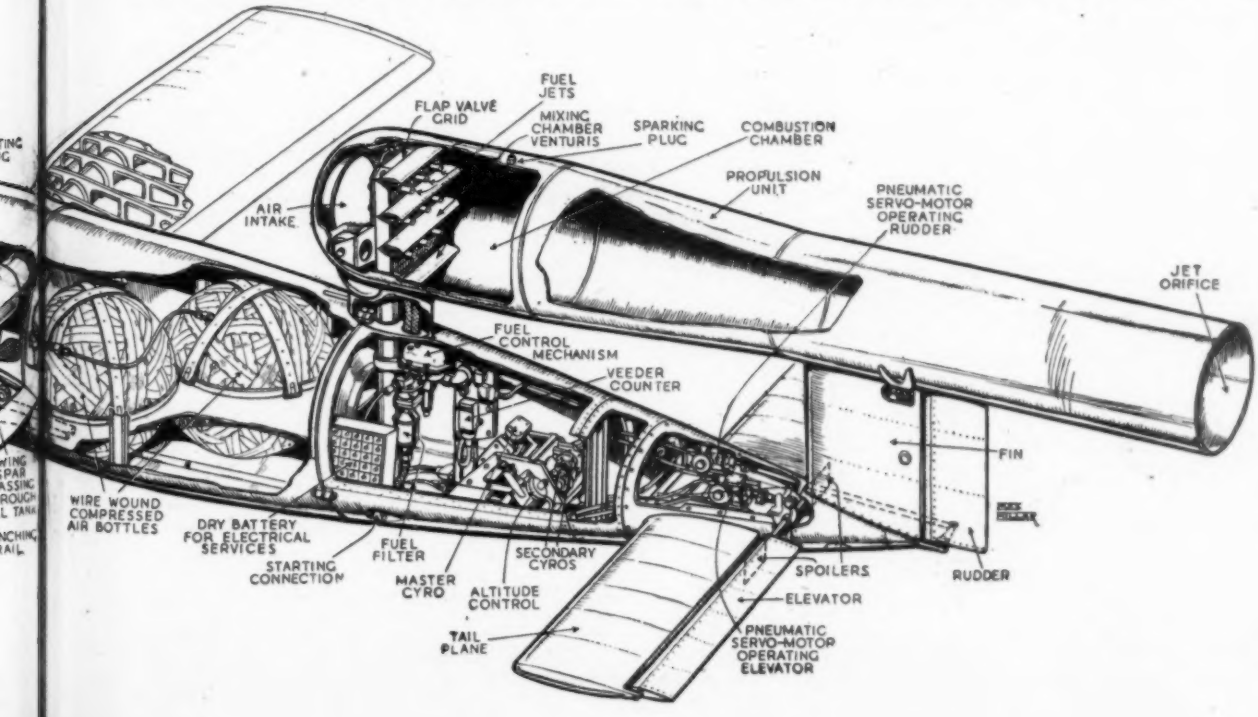
### Construction Features

This V.1. is a remarkable aircraft, and in describing it we must begin, in an unorthodox way, with the petrol tank —since this is essentially the backbone of the whole structure—which is a plain cylinder with domed ends. It carries the launching rail, and is, therefore, subjected to all the catapulting forces, and these probably amount to something like 10g. Also, it is under the high pressure of some 100 lb. per sq. inch which provides the forced petrol feed to the jet-reaction engine. The petrol tank holds about 150 gallons, and the main wing spar tube passes right through it. The single lifting lug, through which the machine is hoisted on to the launching ramp, is also built into the tank. As the tank constitutes the centre portion of the fuselage, and being subjected to all the forces mentioned, it is built of heavy-gauge, mild-steel plate—we guess the thickness at about 12 gauge. A coarse filter panel is built into the bottom of the tank with a finer filter further down the pipeline.

Carried directly in front of the petrol tank is the 2,000-lb. war head or bomb. It is attached by four bolts with external lugs. The war head itself is welded-up from mild-steel sheet of about 14 gauge, thus giving the maximum percentage weight of explosive—this being essentially a blast type of bomb. In front of the war head is a light-alloy fairing with a detachable nose cap built of the same material. The object of using duralumin at this point is to keep down magnetic influences, since the magnetic compass is carried in the nose.

The compass can be pre-set to guide the aircraft on a desired course; it is carried in a large bowl-shaped wooden receptacle. Impact and other fuses are located in this forward structure, as well as the tiny air-log windmill at the extreme nose.

Aft of the petrol tank is a compartment carrying the two spherical air bottles, the construction and purpose of which will be described later. This compartment is welded to the petrol tank, and forms one unit with it. There is then



## WASTED TALENT

a joint at the rear for the attachment of the tail-end of the fuselage, which can be removed as a complete unit by undoing four bolts. The entire fuselage structure consists of stressed skin and bulkheads only—there are no longitudinals.

Of special interest is the tail part of the fuselage. It carries the automatic pilot, with the three air driven gyroscopes, and also the height and range-setting controls. The electrical gear and other gadgets are also fitted in this section, as well as the wireless transmitting unit, when a machine is so equipped. The fin is in one unit with the rear-section fuselage, and is spot-welded to it.

The tailplane, which passes in one piece through the fuselage, has, mounted on top of it, the two pneumatic servos operating the rudder and elevators. All this intricate mechanism is easily accessible through large openings covered by bolted-on panels.

The jet engine itself is carried at its forward end at two points on a trunnion, rather similar to a tail wheel fork, and this fork transmits the engine thrust to the aircraft. The fork itself is a beautiful example of a welded-up steel pressing, made in halves. The aft support of the jet tube is at a single point on top of the fin. All three points are rubber-mounted.

We will return to the impulse jet engine later, so let us now consider the wing. This is built from mild-steel sheet, and is spot-welded throughout. The aerofoil is bi-convex with a chord of 3ft. 5in., and has a thickness at the maximum ordinate of 6¼in.; i.e., 15 per cent. of the chord. The maximum wing thickness coincides with the position of the single tubular spar, which is located 10¼in. from the leading edge, i.e., a little more than 25 per cent. aft along the chord. The ribs are simple flanged pressings with circular flanged lightening holes. We guess the material to be about 22 gauge. The skin is a little thicker—perhaps 20 gauge. The aerofoil used appeared to be of almost symmetrical section, and we would not be surprised if right- and left-hand wings were interchangeable. In that case, the only thing which would make them "handed" would be the camouflage, since all top surfaces are painted olive drab, and the undersides a kind of duck-egg blue.

### Spar Structure

The tubular wing spar is in one piece, and is pushed through a tubular ferrule about $\frac{5}{32}$in. thick, welded into the petrol tank. This tube—the main wing spar—is about 4ft. shorter than the overall wing span. It consists of a single piece of 4¼in. diameter by 12-gauge seamless steel tubing with a 10-gauge open-seam sleeve over most of its length. This is spot-welded through to the inner tube at the seam. A further short length of 10-gauge tube is fitted over the centre of the wing spar to cater for the increased bending moments. The tubular spar takes no wing torque, and in any case torque loads would be low in view of the bi-convex section and the position of the spar. What torque loads there are are taken out at a single point on a strengthened box rib at the fuselage side near the trailing edge. On the machine we inspected, a sharp balloon-cable cutter of steel was fitted inside the leading edge, immediately behind the skin plating.

One could write pages about the construction of this wing—it is extremely ingenious. The top portion of the skin is first spot-welded to the ribs and to the shallow nose and trailing-edge webs. Similarly the bottom skin plating is spot-welded to another series of ribs, etc. The top and bottom halves are then brought together and welded up along the centre line of the vertical webs near the leading and trailing edges. This makes a very strong box structure, and the job is completed by welding-on the small nose and trailing-edge platings. The wing is perfectly flush, all plating joints being butted, and there are no protruding rivet heads.

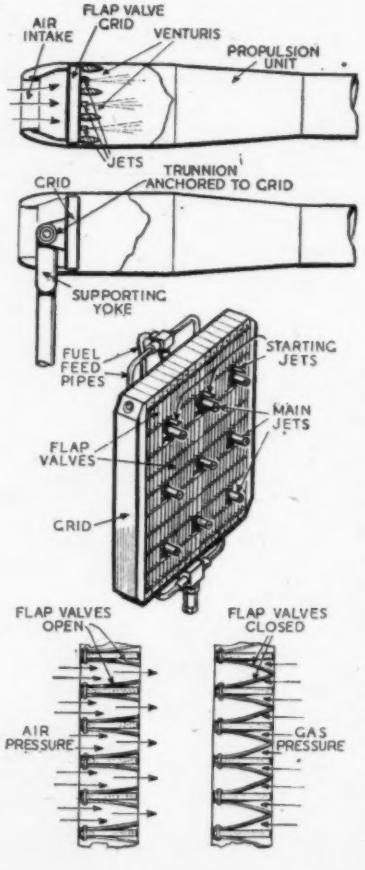
### Compressed-air Bottles

The spherical compressed-air bottles are located in a compartment in the fuselage immediately behind the petrol tank. They are slightly staggered, one to the left and the other to the right of the fuselage axis. The construction is extremely interesting, being wire-bound over an internal shell of welded mild-steel sheet. They contain the compressed air which provides the power for spinning the gyroscopes in the automatic pilot, for forcing the petrol up to the motor, and for operating the pneumatic servos to the rudder and elevators. These latter will probably absorb the bulk of the power, particularly in bumpy weather.

Air at the surprisingly high pressure of 150 atmospheres is compressed into the bottles. The one we examined bore a notice in German stating that it had been proof-tested to 225 atmospheres. A hydraulic test carried out in this country on a salvaged bottle at 3,000 lb. per sq. in. resulted in no leak or failure. Each bottle has an external diameter of about 22in. and weighs 111 lb. when empty. When inflated to 150 atmospheres the weight of each bottle is increased by 31 lb.

The internal mild-steel shell is pressed out in two hemispheres and welded round the equator. The spheres are then wire-bound with what is apparently 16-gauge piano wire under considerable tension. This wire winding may be three or four layers thick and takes great-circle courses in twin bands about 1½in. wide, fixed with soldered tinned-steel clips. The two bottles are coupled together and therefore become in effect one container, in that if one were punctured the air would leak out of the other also. The high pressure in the bottles is broken-down through a reducing valve to a working pressure throughout of about 100 lb. per sq. in.

The impulse duct engine is a new and extraordinarily fascinating form of power plant. Its only working parts are small spring-steel shutters in the frontal grill. These form what are in effect non-return valves and allow air to pass through the grill into the explosion chamber of the engine. This power unit has a maximum diameter of 1.9ft. with an overall length of 11.25ft. The shell is built-up from welded mild-steel sheet of heavy gauge. No parts, except the small nose cowling, have any double curvature and therefore the shell can be readily formed from flat plates bent into cylindrical form and gas-welded down the single seams and ends. These welded seams are staggered on adjacent




**Operation of the impulse duct engine of the flying bomb.**

## WASTED TALENT

sections for obvious reasons. The tail pipe of the unit appeared to be about 12-gauge thick. There are no internal parts inside the tubular casing except for three horizontal louvres or venturis immediately behind the frontal grill. This grill is built-up from excellently moulded die castings, and it carries nine petrol jets in the face, each having a nozzle aperture of about $\frac{1}{16}$in. diameter.

Of special interest are valves which comprise in all 126 double rectangular leaves of very thin pen-nib steel, i.e., 252 leaves in all. They are formed to press against each other lightly on their inner edges, and the arrangement will be clear from Max Millar's sketches. They constitute small non-return valves, closing the grill against excess pressure from within but opening readily with higher differential pressure from outside.

### Power Unit Operation

Three small compressed-air nozzles connected to an external supply on the launching site are located immediately above the upper row of three petrol jets. These jets are used for starting the engine prior to launching. An ordinary sparking plug is located externally about 2½ft. down the casing behind the grill. Like the three jets this plug is used only for starting the engine on the launching platform.

We have heard some weird and wonderful explanations as to how this unit functions, but it is, in effect, a simple blowpipe and is a pure jet or reaction propulsion engine. There is no turbine or compressor, and the only compression present is that due to ram effect at, say, 360 miles per hour and would not in any case amount to more than a fraction above one atmosphere.

Let us assume that the machine is in flight at top speed with the motor functioning, that the frontal shutters are closed, and that an explosion is taking place inside the engine. The gas pressure so generated cannot get out through the non-return valves, nor can it blow open the wall of the pipe. It therefore propels the mass of burning gas down the pipe towards the exit and the open air. Now to move a mass of any kind requires a force. There is also an equal and opposite reaction to that force and this, acting on the closed shutters of the grill, produces forward thrust on the aircraft. Further, once a mass has been put into a state of motion it requires a force to stop it. The burning gas hurtling through the tube therefore tends to continue moving because of its inertia (or momentum, if you prefer it).

As the mass progresses down the tube, the force tending to oppose it is a gradually increasing depression behind the grill. When this depression has reached a certain point the shutters are forced open, assisted by the ram effect from outside, and a new charge of air comes through into the combustion chamber. This immediately burns, heats-up and expands, producing high pressure which closes the valves. The mass whistles down the tube, drawing a new charge behind it. The effect is rather similar to what is called "wire-drawing" on long racing-car exhaust pipes, which feature permits of considerable overlap of inlet and exhaust valves, thus helping to scavenge the burning gas from the cylinder heads of normal automobile piston-engines.

The frequency of the explosions in the motor is about 45 per second, i.e., 2,700 per minute. This almost corresponds with the cruising r.p.m. of modern aircraft engine crankshafts although not, of course, with the cylinder explosions. It does, however, correspond exactly with the power impulses of a single-cylinder two-stroke motor cycle engine running at 2,700 r.p.m.

It seems probable that there will be terrific vibration on this particular power unit, and this accounts in part for the fact that the whole engine is mounted on very large rubber trunnions. The forked yoke supporting the front of the unit transmits the engine thrust to the aircraft. With so many explosions per second the combustion of gases down the tube is practically continuous, and the petrol jets are spraying continuously. In an engine of this type the frequency of the explosions is determined by the resonance frequency of the tube, and the time for one cycle will be equal to twice the length of the tube divided by the velocity of sound. We have no information as to the velocity of sound through gases heated to maybe 900 deg. C., but by dividing twice the length in feet, i.e., 22.5 by 1,100, we secured a figure for the time cycle of 0.02 seconds, i.e., 50 explosions per second. We feel that designers of organs and particularly of organ pipes would understand this perfectly and indeed much better than we can hope to do! The depression wave will start at the tail orifice and travel rapidly forward up the tube to the mixing chamber immediately behind the grill.

We understand that the Germans are operating these machines with ordinary motor spirit of quite low octane number. This is to be expected in view of the extremely low initial compression of the gas, which in turn partly explains the very low thermal efficiency of this engine. It develops a thrust of approximately 600 lb. at a speed of 360 miles an hour, at which velocity the drag of the aircraft is about equal to the thrust. Under such conditions it will be developing 575 thrust horse-power, equivalent to about 725 b.h.p. from a normal piston engine and airscrew. Its petrol consumption is about one gallon every 10 seconds, in which time it will fly one mile. The comparable thermal efficiency of this jet-engined "doodle-bug" can be assessed in true perspective when you consider that its petrol consumption per mile is about equal to that of a fully-loaded Lancaster bomber whose engines develop some 6,000 h.p.

### Launching the Missile

It has been disclosed that this machine can be launched pick-a-back from another aircraft—probably the Heinkel 111. This obviously would not present any particular difficulty from a technical standpoint. The pilot could ascertain that the jet engine was functioning properly before he released the contraption. The German flying bomb was, however, designed for launching from a stationary ground platform, preferably a heavy permanent structure. Doubtless with the bombing of these sites the Germans improvised and developed comparatively light and readily transportable platforms.

From an examination of the machine, some deductions can be made as to the probable starting procedure. Let us assume that the aircraft has been erected and inspected, lifted on to its launching trolley, the tank has been filled with petrol, sealed down, and the air bottles inflated to 150 atmospheres. The magnetic compass in the nose has been set on a calculated course, based either on the meteorological data immediately available, or possibly on the trial flight of a "doodle-bug" equipped with wireless transmitter. The height and range-setting controls have all been adjusted, and the rocket apparatus for propelling the aircraft along the runway is in position. The compressed air is turned on, starting the gyroscopes and blowing up the petrol tank. An external compressed air or gas supply has been connected to a fixed point on the aircraft fuselage communicating with the three air jets into the combustion chamber, and a connection has been made to the sparking plug from a starting magneto or coil.

The petrol is turned on and begins to spray through the nine jets into the combustion chamber along with compressed air from the three jets. A spark at the plug ignites the mixture and the motor starts. It will now be operating like a gigantic blow-pipe. There will be no ram pressure in front of the grill, unless it is supplied artificially, and this seems unlikely. In this condition the engine would produce practically no thrust. However, the point is that it is functioning, and when it has warmed up so that it will pre-ignite satisfactorily, the sparking plug connection is removed and the machine is ready for launching.

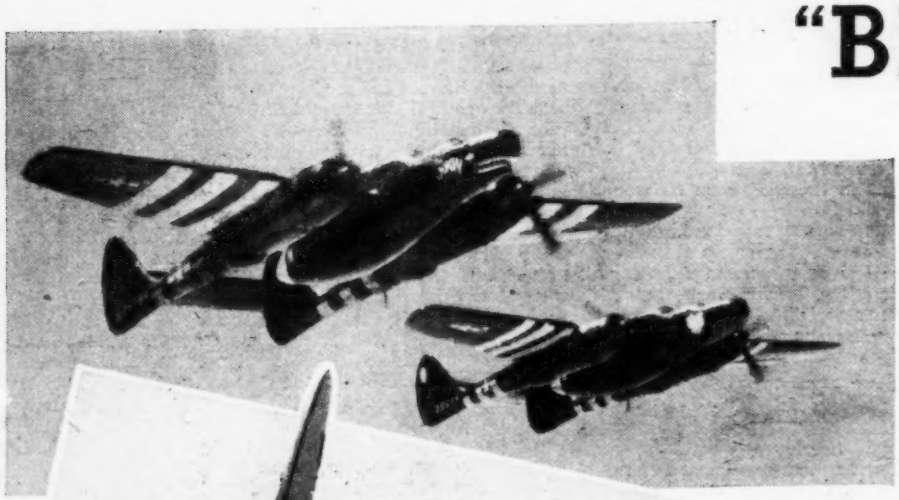
For the launch, rockets are used, probably of the bi-fuel

(*Continued on page 370.*)

# "BLACK W

## *Northrop P-61 Amer*

## Nigh ight



(Left) Two striped "Black Widows" on patrol. The U.S. 9th Air Force are using these machines in France.

(Above) This three-quarter rear view shows the wide field of view afforded the rear crew member and gives a fair idea of the aircraft's size, although the foreshortening of the fuselage is flattering.

The rear man handles all the complex radio gadgetry attendant upon navigation and target finding.

(Right) The rearward-retracting, cantilever-axle undercarriage is in accordance with standard American practice. Note the torque drag links which prevent the lower leg rotating in the upper member.

THE P-61 "Black Widow" is in fair accord with the Northrop precedent of unorthodox machines, but this their latest effort, as well as being the largest and heaviest night fighter to go into Allied service, is undoubtedly the ugliest aircraft in its class.

Looks, of course, are not a qualifying factor in the assessment of an aircraft's ability to do its job, and for that the "Black Widow" may be thankful.

Performance figures are not releasable, and this also applies to all specific details other than broad general items. The machine is powered by two Pratt and Whitney G.R. 2800 engines, each of 2,000 b.h.p. and driving four-blade airscrews. Weight is given as more than 25,000 lb., which gives a power loading of something in excess of 6¼ lb./h.p.—a reasonable figure which should result in quite a nippy performance, if so ungainly an aircraft could ever be called nippy.

Wing span is 66 feet and wing area and aspect ratio are respectively estimated as 500 sq. ft., and 8.7. Extrapolating gives a wing loading of over 50 lb./sq. ft.—a fairly high value which reflects the need for an advantageous power loading and also for the unusual full-span flaps which give the aircraft a slow landing speed. This, in turn, apparently made a modified aileron necessary, the result being said to have provided great manœuvrability under normal flight conditions.

Rate of climb is supposed to be very good, but no indication of speed is given. Tactical range is also said to be extensive, but there are no comparative figures.

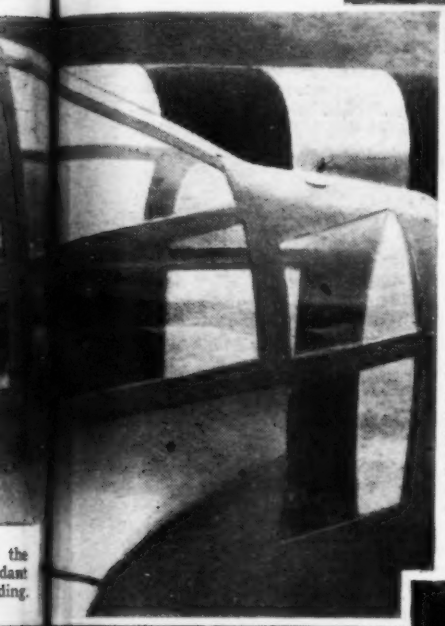
Armament comprises four 0.5 m.g.s in a dorsal turret (above and behind the pilot) which, however, is not always fitted, and an unspecified number of 20 mm. cannon located elsewhere. The crew is two, or occasionally, three.

There appears to be little necessity for this aircraft at the moment unless, of course, it is being used for duties other than night fighting. For day operation the machine should be fairly easy meat for modern fighters—despite its turret—but the enemy has not of late shown much inclination for aerial fighting. For night fighting it is difficult to see that the Black Widow should be more effective than the Beaufighter or Mosquito.

# K WIDOW"

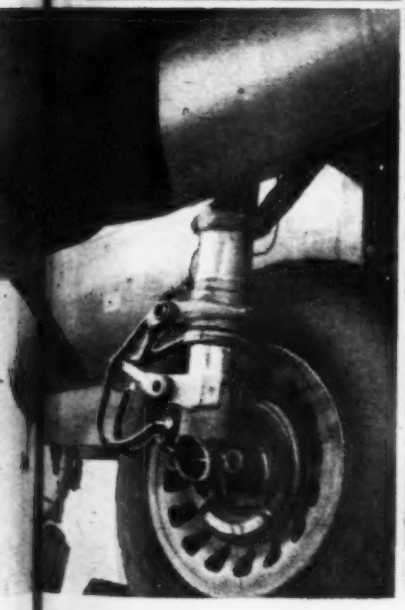
## P-61 American Big-Ship Night Fighter

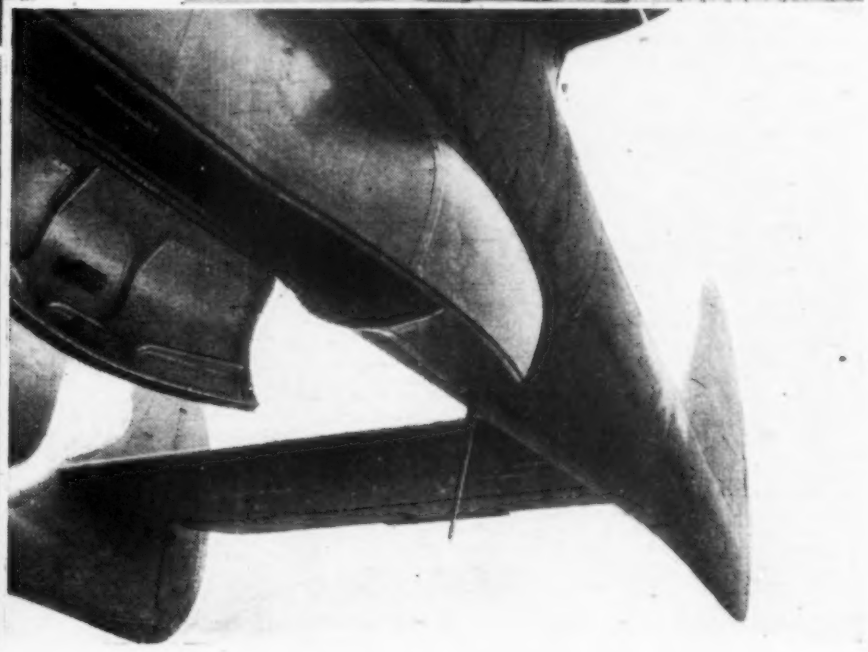
"Black Widows" are 48' 11" long and the bulbous-bellied fuselage carries a load of very hush-hush radio equipment.



(Right) Unlike the Lockheed Lightning, the dark lady's cuffed airscrews both turn in the same direction.

(Below) The tail unit showing the full-span tailplane and elevator. Rudders have set-back hinges for aerodynamic balance.





## WASTED TALENT

type, using perhaps petrol and liquid oxygen. We say this because the B.B.C. disclosed recently that we had bombed a German factory producing peroxide of hydrogen, which the B.B.C. stated was used in the launching of flying bombs. Hitherto we had thought its only use was in the production of platinum blondes!

With the rockets firing, the aircraft is accelerated violently down the runway, assisted in an increasing measure by the jet engine. The force will probably correspond with a maximum acceleration of about 10g. It will be necessary to reach a speed of nearly 200 m.p.h before the machine is released from its launching platform. This will be fairly obvious, since its stalling speed is around 150 m.p.h., and it is certain that the jet engine would not begin to function efficiently until a velocity approaching 200 m.p.h. was reached. It will be seen that, unless the thrust from the engine exceeds the drag of the aircraft, it will not accelerate when in free flight. Once over that critical speed, the thrust doubtless will build up to a peak figure and descend again with still further increase in velocity. At some point the thrust from the motor and the overall drag of the aircraft will be equal, and then the aircraft will reach a steady and stable condition of flight—probably at around 360 m.p.h.

Once on its course the ground crews can do nothing more about it. The fundamental defect of this machine is that its first test flight is its last, and there are such a multiplicity of bits, pieces, gadgets and adjustments, that something or other is almost certain to go wrong. It is fundamentally an inaccurate, and therefore indiscriminate, weapon; and although the Germans could doubtless have improved its accuracy and efficiency—given time and experience—it is to be hoped that the opportunity has now gone past.

### Function of Air-log

Mounted on the nose of the fuselage is a freely rotating windmill or air log which actuates a Veeder-type counter. It is an extremely important bit of mechanism, as it is responsible for the arming of the bomb after some 60 kilometres have been covered, and it also controls the range of the machine. Further, on those aircraft fitted with a wireless transmitter, the nose windmill through the counter starts up the wireless some 56 kilometres before the calculated destination. The Veeder counter is set to a figure which, all things considered, should determine the required range of the machine. As the windmill spins in flight the Veeder counter figures return gradually to zero, and at this point two electrically fired detonators in the tail of the fuselage are discharged. They blow out a piece of metal, forcing down small "spoiler" flaps on the tailplane, the effect of which is greatly to increase the lift on the tail. At the same time the elevator push-rod is jammed, and a guillotine severs the pneumatic controlling tubes of the rudder servo which becomes locked. This quick succession of events puts the machine into a steep dive. Centrifugal force caused by the radius of the curve throws any remaining petrol to the top of the tank, thus cutting out the motor. Undoubtedly this action is incidental and not intentional. When the machine strikes the ground the warhead is detonated by the various fuses in the nose.

### Automatic Pilot

This consists of three air-driven gyros (a master gyro and two secondary gyros) with height and range-setting controls. The master gyro controls both elevators and rudder through pneumatic servos. The secondary gyros provide damping against phugoid oscillations. The master gyroscope will maintain its axes of rotation in a fixed direction for a long period of time. It thus provides a definite fixed direction in the aircraft, and any deviation from a pre-set course is detected by the gyroscope, which moves the control surfaces through the pneumatic servos to correct the deviation. The gyroscope tends to wander off its initial setting after some time, and, to counter this, a magnetic compass has been added in the nose. Electrical connections from this compass police the gyros' direction in a horizontal plane. The flying height is set on the automatic pilot by a simple dial. It gives a choice of operating heights up to 10,000ft., the usual height being about 2,000ft., and few bombs have been encountered above 5,000ft. Height control at the master pilot is through an evacuated metallic capsule which expands with a decrease of atmospheric pressure, and vice versa, thus indicating to the automatic pilot that greater or less altitude is desirable.

The electric supply is from a nest of 42 dry cells of 1½ volts each, coupled in two parallel blocks of 21, thus giving some 30 volts. One of the most cunning gadgets on the whole aircraft is the automatic petrol supply control to the engine. This is actuated by a simple pitot which opens up the petrol supply with increase in speed. Another evacuated metallic capsule expanding and contracting with changes in altitude and pressure overrides the pitot control, tending to cut down petrol supply with increased altitude. There is even a third override in that if pressure inside the jet engine should reach dangerous limits, the back pressure on the petrol jets will also cut down petrol supply, thus restoring conditions to normal.

## EMPIRE AIR SERVICES PLAN

MR. A. S. DRAKEFORD, Australian Air Minister, in a statement to the House of Representatives on Commonwealth civil aviation policy, announced a proposal that all Empire Services in the Pacific should be operated by the Air Forces of Australia, New Zealand, Canada and Britain, using military transport aircraft.

Mr. Drakeford said that it was also planned to extend the service between West Australia, Ceylon, and Karachi, linking with the B.O.A.C. to provide full passenger and air mail requirements.

Mr. Drakeford emphasised that the proposal did not mean that Australia advocated that the British Commonwealth should take the place of, or compete with, any other national operators or group of operators. Australia still advocated support for the international operation and ownership of prescribed routes by an international authority appointed by the United Nations.

The Government believed, he said, that the Empire plan should provide for the inclusion of any other nations which wished to join the scheme, and this would be suggested at the forthcoming air conference.

Mr. Drakeford added: "Hitherto the bulk of the Pacific air services have been operated by the American authorities. Now the Australian bases operated on behalf of the American transport command are being used less and less as troops move north, and it is possible that soon the American terminus will have moved to the north of Australia altogether.

"There will then exist the need, for the convenience of military and other high priority personnel, of a service between North America and Australia."

Outlining their post-war policy, Mr. Drakeford said his Government had made two alternative proposals:

1. Operation and ownership of all international air trunk routes and aircraft employed thereon by an international air authority to be created through international agreement.

2. Control and operation under Government ownership of air trunk routes by the Governments of the British Commonwealth.

The first proposal, he said, had not received the support that the Australian and New Zealand Governments expected, but the Australian Government would continue to urge an understanding among the United Nations for co-operation.

"This is felt to be necessary," he declared, "both in the interests of world security against possible misuse of civil air fleets in future, and in order to obviate the disastrous effects of unregulated competition in the race to become predominant in world air commerce.

"The Government realises that great difficulties may be experienced in achieving that objective because of the ambitions of certain countries to become predominant in air commerce."

Australa would co-operate in re-establishing a full passenger, mail and air freight service between Britain, Australia and New Zealand with a frequency at least double that existing before the war. British aircraft would be employed as far as practicable.

# Jet Propulsion and Adiabatic Expansion

## *Theoretical Jet-velocities of Oil-heated Air at Various Temperatures and Pressures*

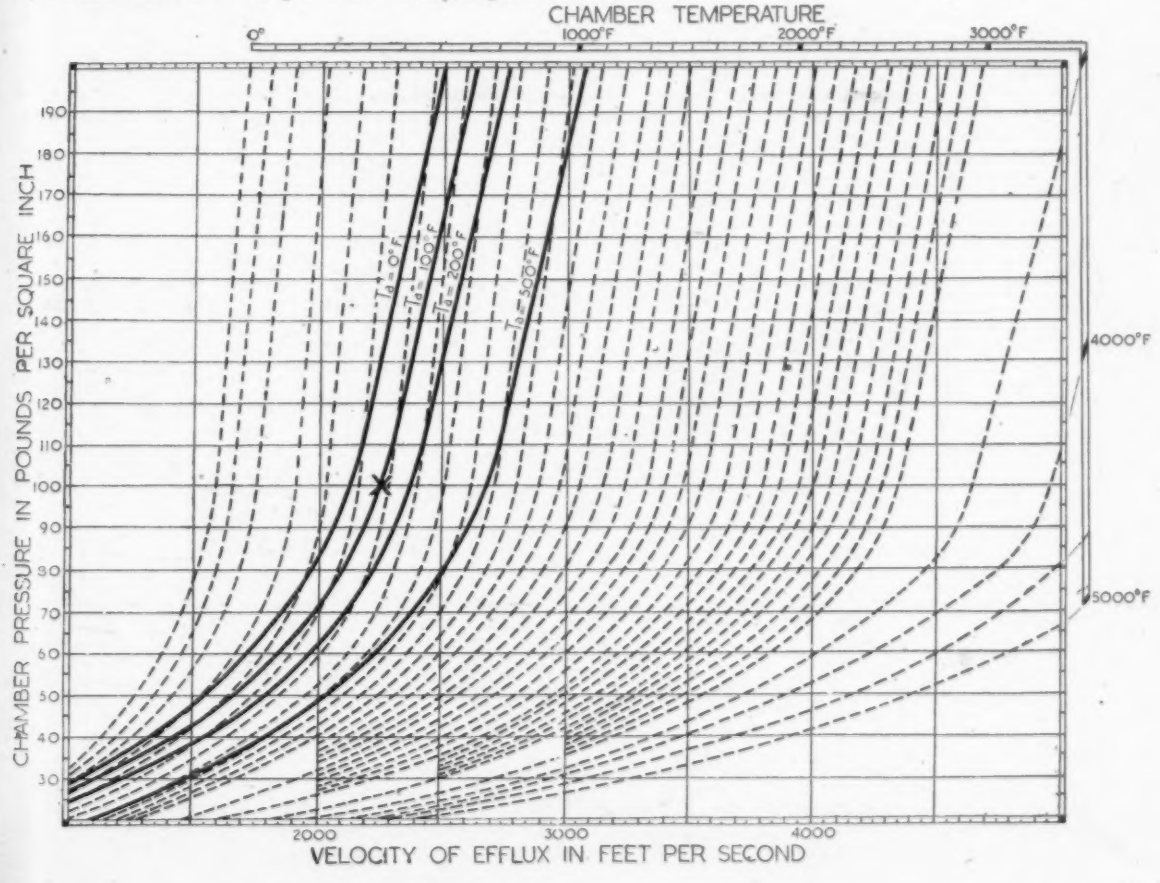
By E. BURGESS

THE normal jet-propulsion system employs the adiabatic expansion of air for converting the pressure and heat energy of the working fluid in the combustion chamber into kinetic energy in the exhaust stream. In a rocket, this adiabatic expansion is also employed; it takes place in the de Laval type of convergent-divergent expansion nozzle. If high values of propulsive efficiency are required it is necessary to inject a large quantity of air into the exhaust stream of rockets which are designed to operate within an atmosphere. The jet-propulsion idea is really an advanced development of the air-augmented rocket, but for jet-propulsive systems the prior purpose of the fuel is changed. The main operation of the fuel carried in a rocket is to eject its own mass with a high velocity, thus propelling the body of the rocket in the opposite direction. In the liquid-fuel, jet-propulsion system, however, the purpose of the fuel is to apply heat to the injected air which ultimately forms the main mass of efflux.

The purpose of the graph which accompanies this short note is to give the efflux velocities of heated air for various temperatures and pressures of the combustion chamber. Complete adiabatic expansion is assumed to take place from combustion chamber pressure to ambient pressure. The dotted lines indicate this adiabatic expansion for various combustion chamber temperatures, no note being taken of the temperature of the efflux. The thick lines indicate adiabatic expansion to ambient temperature and pressure, and give values of combustion chamber temperatures and pressures for different efflux velocities, so that the efflux emerges at ambient temperature and pressure. Four curves are shown for efflux temperatures of 0, 100, 200 and 500 deg. F. Ambient pressure is regarded as being 14.7 pounds per square inch.

An example of how to read the graph follows: Consider a combustion chamber pressure of 700 lb. per square inch and the efflux temperature to be 100 deg. F. The point X on the graph represents where the thick temperature line Ta = 100 deg. F. crosses the line representing the chamber pressure of 100 pounds per square inch. From this point it can be seen that the chamber temperature should be 480 deg. F., and that the efflux velocity should be approximately 2,250 feet per second.

It must be remembered that one hundred per cent. thermal and nozzle efficiency are assumed for the purpose of these calculations. Suitable reductions must be made for inefficiencies in both the thermal cycle and the expansion nozzle.



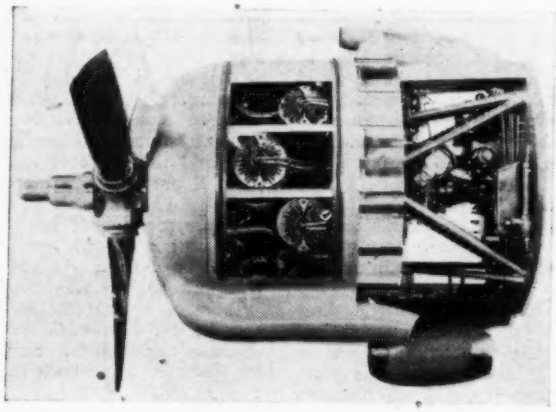
# Complete Power Units

## A Reminder That Bristol Radial Air-cooled Engine "Eggs" Were Produced Twenty Years Ago

*AT the B.O.A.C. lunch to celebrate the 25th anniversary of the inauguration of the London-Paris air service Lord Brabazon of Tara said that he was told that Rolls-Royce was the only firm which would take on the entire responsibility for the complete power unit.*

*The Bristol Aeroplane Co., Ltd., has sent us the accompanying reminder of early work done in this field, and point out that even for the latest type, the Centaurus, a complete interchangeable power unit is available.*

A REMARK made by Lord Brabazon in a recent after-luncheon speech in London may have given the impression that air-cooled radial aircraft engines are not available in this country in the form of complete power plants. This is very far from being the case. The Bristol Hercules sleeve-valve radial engine as a complete power plant, including all cowling, accessories, bulkhead and standardised four-point airframe mounting attachments, was exhibited at the Paris Aeronautical Salon in November, 1938. Since then, Hercules power plants have been manufactured in thousands to equip the heavy bombers and transports of the Royal Air Force, and there is no doubt whatever that they will be used also in the post-war civil air liners. Also the new and most powerful Bristol product, the Centaurus radial engine, is already installed in complete interchangeable power plant form in a certain large type of flying boat, and although secrecy regulations prevent the publication of any detailed information, it can be said that this latest Bristol power plant will appear after the war, in developed form, in large civil transport aircraft sponsored by Lord Brabazon's own committee.



It is interesting to recall that as long ago as 1924, the famous Bristol Jupiter was produced as a self-contained, hinged power plant for the Bristol Civil Transport or freighter aircraft, which was operated on the London-Paris route for some years. The engine and all accessories were installed in a four-point mounting structure with quick-release attachments, in such a way that the power plant could be hinged sideways on two of the pick-up points to facilitate inspection and maintenance.

It is equally as interesting to recall that in point of fact the present type of Bristol power plant originated in 1937, when the Air Ministry approached the Society of British Aircraft Constructors and asked them to prepare a scheme whereby engines of similar horsepower, but of different types, could be interchangeable at no more than 48 hours' notice at aircraft constructors' works. The Bristol design staff worked in the closest collaboration with the special committee set up by the S.B.A.C. as a result of this request, and although the scheme as originally proposed did not come to full fruition (due largely to the exigencies of the war expansion programme), the Bristol Aeroplane Company continued with the greatest activity to develop their design of power plant for the Hercules engine, with the result that such power plants were available in quantity production for the start of the new heavy bomber programme early in the war.

The latest Hercules power plant is standardised to include the following equipment additional to the engine itself:—

Engine mounting; bulkhead and fittings; engine cowling; controllable cooling gills, with electric driving motor; inter-cylinder baffles, etc.; nacelle shoulder cowling and supports; fire extinguishing system; fuel system, including filter; oil pipes; exhaust system, complete with flame damping and cabin heating equipment; engine control system; electric starter, with hand turning gear attachment; miscellaneous electrical equipment, including tachometer, etc; carburettor air intake, with by-passable air cleaner.

The following is added to the standard power plant to suit the particular aircraft requirements:—

Engine-driven gear box for aircraft accessories; aircraft accessories fitted to gear box; oil cooler; nacelle and fairing panels; airscrew controls.

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### AIR/SEA RESCUE

MORE than a hundred lives have been saved by the R.A.F. Air/Sea Rescue Service in one day alone during the airborne invasion of Holland. This statement was made this afternoon at the Fighter Group H.Q. of Air Defence of Great Britain, where the rescue operations on the largest scale ever known were planned.

Beginning on Sunday when rescue launches were sent out before dawn to form a chain right across the North Sea, and rescue aircraft of A.D.G.B. patrolled as spotters overhead, the rescue line has been saving lives continuously each day.

Typical of the invading airmen's opinion about the organisation was a tug pilot's comment: "When we first went in," he said, "navigation was practically pointless, we simply followed the A.S.R. line."

On Sunday the launches were spaced at such frequent intervals that each was in sight of the next in the line. If a glider ditched off the line, the spotting R.A.F. aircraft gave their directions by radio and the launches dashed to the spot.

"Launches have picked up the great majority of the ditched men each day, including the peak day of over 100 saved," said the R.A.F. staff officer who planned the rescue arrangements, "but amphibian aircraft have gone down for some of them. The R.A.F. Air/Sea Rescue Service quickly brought in vessels from more distant bases to reinforce the line leading from the East Coast."

### CANADIAN LANCASTERS

VICTORY AIRCRAFT, Ltd., Toronto, was given an order in August for an additional 300 Lancaster bombers, it was recently announced at Ottawa by Department of Munitions and Supply. Victory Aircraft is a government-owned and operated plant.

# Post-war Private Flying

## *Great Britain's Wonderful Opportunity : Converting the Air-conscious Citizen into an Air Enthusiast : An Aircraft Owners' and Pilots' Association*

By JAMES C. FITZMAURICE, Col. (Retd.)

OUR experiences over the past five years have made it abundantly clear, even to the most dim-witted, that until such time as we have developed sufficient wisdom to direct the scientific and mechanical products of that complex thing the human mind into the polite channels of peaceful progress, and not, as has been our sad lot in the past towards our own destruction, we must in the days to come forever be on the alert and prepared to deal with any threat which may be levelled against us. Never again can we afford to be caught in that state of unpreparedness which called down upon our heads the trials, sufferings and humiliations which we have so recently endured, and which are still so fresh in our memories.

Of all those products of the human mind which have so nearly led to our destruction the aircraft is undoubtedly the most important. It has completely revolutionised the whole art of war. It has brought war in its most horrific form to the very doorstep of every man, woman and child in the land. It has taught us a most salutary lesson. That lesson is to be found in a sound appreciation of the fact that the strength and security of the nation in the future will depend to a considerable extent upon our actual power in the air. It is, however, an equally obvious fact that no nation, no matter how rich, can afford to maintain in time of peace the military air strength it will require in time of war.

*THE author of this provocative article on a controversial subject is well known to older readers, but for the benefit of the younger generation a brief outline of his distinguished career may be useful.*

*In the first World War he served in the cavalry, infantry, R.F.C. and R.A.F. In 1919 he served in 120 sqn. R.A.F., as navigation officer and air mail pilot on the experimental Folkestone-Cologne air mail. He was personally commended by Sir John Salmond for his part in the first experimental night air mail flight to Cologne in May 1919, on a D.H.10.*

*With two Germans, Capt. Köhl and Baron von Hunefeld, he made the first east-to-west transatlantic flight in a Junkers monoplane, Bremen, in 1928. It was from Ireland to Labrador, and was made without wireless. For this flight he was awarded the American D.F.C.*

*Col. Fitzmaurice organised and commanded the Irish Free State Army Air Corps, and in 1934 he was an entrant in the England-Australia race, but could not start as he was refused an airworthiness certificate for his Bellanca monoplane, Irish Swoop. He has also been a private owner of aircraft and has had wide experience of private flying at home, on the Continent and in America.*

Col. J. C. Fitzmaurice.

### Military and Civil Air Link

The logical corollary to this, if we are to continue to be a great nation, is that our air power must be based upon a *corps d'élite* Air Force, of a size commensurate with our national and international obligations, backed by a flourishing aircraft industry, with an alert research and development programme, and finding its main support in expansive, successful, self-supporting civil air transport and private flying operations.

For a variety of reasons, which do not call for any elaboration here, this latter branch of our air activity is by far the more important. It will represent the major portion of the world's aeronautical endeavour. It, therefore, calls for our most earnest and serious consideration if we are to retain that supremacy in the air that will bring progress, prosperity and security in peace after it has helped us achieve victory in war.

With these thoughts in mind it is clear that those of us who for our sins are involved in the aircraft industry have, apart from any selfish interest, a high duty to perform as good citizens if we are to fulfil faithfully the obligations which are ours in regard to this particular sphere of the nation's future activities. The job is a man-sized one worthy of our metal; it calls for the exercise of the greatest diligence coupled with the most untiring, fanatical effort. We shall start, however, with a terrific advantage.

That advantage lies in the fact that the particular branch of the industry concerned with private flying is somewhat in the position of a man who, through some mystical agency, is allowed to relive his youth strongly fortified by the wisdom of maturity. Having struggled through a very weak and sickly early infancy, survived the torments, pains and mistakes of a troublesome adolescence, it is now given the miraculous chance of starting all over afresh. And, what is equally important, in this rebirth it will have the strong support of an enthusiastically keen, air-conscious public, fully aware of the enormous part played by our air strength—weak though it was—in the preservation of our liberties in the grim days of 1940 when those same liberties were so dangerously imperilled.

It is difficult to conceive of a more promising situation. If we fail to realise this situation and take full advantage of it, then we are a very poor lot indeed. Fortunately, however, our industry, through its very nature, has from its inception attracted into its ranks men possessed in a high degree of those worthy qualities—imagination, vision, brains, courage, and a high sense of adventure. What, then, is to stop us? Nothing but sheer, blind selfish folly. Of this we must beware; for it is a regrettable fact that the war growth of the industry has led to the inquisitive interest of certain undesirable types who know nothing about the business, have contributed nothing to it in any way, shape or form, and who are concerned only with the amount of money they may be able to make out of it. We must shun such gentry as we would the plague.

In looking to the future, the primary consideration is the necessity for a sound, co-operative, basic programme in which all those genuinely interested in the healthy expansion of private flying agree unselfishly to act as fanatical crusaders in the work of bringing aviation within the reach of the ordinary man of moderate means and average intelligence. He is the market it is our job to develop and foster. The war has made him air-conscious; he must now be made air-enthusiastic. And that should not present any difficulty if the problem is approached in a practical fashion; for, after all, he is a very practical fellow. He is the man who made possible the creation of the great automobile industry which is to-day such an important feature in our national life and economy.

### John Citizen, Air Enthusiast

In approaching the problem of converting our air-conscious citizen into an air-enthusiast we must keep clearly in mind the fact that, though keen, this particularly important person is, generally speaking, rather ignorant in regard to the whole matter, and possessed of the erroneous belief that the art of flying is a highly involved technical affair calling for certain super qualities found only amongst the

# POST-WAR PRIVATE FLYING

select few who are fortunate enough to be well endowed with this world's goods. The explosion of that stupid myth should be the very first item on our agenda. We must impress upon the public mind that it is as simple to learn to fly a modern light aircraft as it is to learn to drive a motor car.

But we have the example of the automobile industry. We cannot do better than copy that example, if only for the reason that the automobile owner of to-day will be the private aircraft owner of to-morrow; after all, the private flying machine is nothing more than the automobile of the air. It is an automobile which, with the simple addition of lifting and control surfaces, can operate in a new medium of unlimited space, offering unhampered freedom, wherein exhilarating speed can be utilised and enjoyed with a degree of safety and comfort which, it is sad to reflect, is not to be found on our roads to-day.

## Design for Flying

It seems only a few short years ago that the automobile industry was faced with the problem of making the ordinary citizen an automobile enthusiast. Then the automobile owner was a member of that select, wealthy section of the community who could afford the luxury of a motor car for pleasure. Realising that the demands of such a small circle could never lead to the creation of a great industry, those interested went to work with a will to popularise motoring, not only for pleasure and sport, but also as an indispensable adjunct to the operation of one's business. They designed cheap, simple cars; established the Automobile Association and the Royal Automobile Club; brought pressure to bear upon the Government authorities to convert roads designed for horse transport to the standards required for motoring; set up motoring schools, service depots and filling stations; and introduced a nation-wide network of qualified mechanic scouts whose duty it was to aid those in difficulties. Their efforts were well rewarded; the results speak for themselves.

Let us take off our coats and go to work in a similar manner.

The first essential is the creation of an organisation to be called, let us say, the Aircraft Owners' and Pilots' Association, affiliated to the Automobile Association which already maintains an aviation department. In putting forward this suggestion the writer is perfectly aware of the fact that the Royal Aero Club operates a Private Flying Committee. He has, however, yet to be shown what this particular committee has ever done for the promotion of real private flying. It would appear that, with a few exceptions whose recommendations aren't taken too seriously, this committee, as pilots, shares with the original Pontius, of revered memory, an appalling tendency towards "washing their hands" of anything original that savours of dynamic action in the interests of real private flying. But, let us give credit where credit is due; as organisers of sports flying events, such as the King's Cup Race, etc., the R.Ae.C. Race Committee cannot be improved upon. So let us leave this good work in the hands of this committee whilst the A.O.P.A gets on with the bigger and more serious job.

The officers of this proposed new association should be experienced, enthusiastic pilots possessed of aggressive initiative and sound organising ability. They should be employed on a full-time basis. Toadying little "Yes-men" should be sternly excluded from their ranks. Their duties should consist in the main in the creation of the necessary organisation to guide and encourage the industry in the design and production of cheap, safe flying equipment which, in addition to sports and pleasure, can be employed for useful and practical purposes; foster a national movement for the establishment of landing strips, or air parks, as distinct from commercial airports, suitably denoted by navigational and locational markers, throughout the country; aid in the preparation of a simple Air Code to govern private flying; assist in the establishment of a civilian flying training scheme; encourage the preparation of cheap, clearly-defined air maps which can be obtained on loan at moderate cost from local libraries; prepare a simple system of flying control; and encourage in every way possible the setting up of a national network of service stations for the private owner, similar to that available to the motorist.

In planning the landing strip system the assistance of the local governing authorities in all centres of population should be enlisted. These bodies should be encouraged to form an aviation committee which will be responsible for the provision of flying and service facilities in the centres which come under their control. In order to obtain the most efficient results, the A.O.P.A. should act as the national guide to the National Councils' Aviation Committees. Each county council's aviation committee, working in close co-operation with the A.O.P.A., should co-ordinate the efforts of the local cities' and towns' aviation committees within their jurisdiction in the work of developing and putting into operation plans for the establishment of a unified system of lay-out, control, maintenance, service, navigational and locational markers. Such local authorities will be only too pleased to give their full support to this work as soon as they appreciate the importance of such development to the future prosperity of their particular communities.

The establishment of this national system of landing strips presents no difficulty and involves very little individual cost. The strips should be located as close as possible to the centre of activity in each city and town, away from any commercial airport, and if possible beside a main thoroughfare. They should be not less than 1,000 feet long by 200 to 300 feet wide, giving a clear approach from any direction, and equipped with a wind-sock, navigational marker and numerical address which is clearly indicated on the contemplated air maps. A small service depot should also be available capable of executing simple adjustments and repairs. Provision should also be made for the supply of petrol, oil and water. The service depot would supply the motor transport connecting with the city or town. Such a network of landing strips would make the private aircraft an extremely useful instrument and reduce the art of navigation to an elementary simplicity comparable with the national road signpost system, which enables the ordinary person, ignorant of a definite route, to drive his car from A to B without the aid of a map. In addition, it would considerably improve the safety factor, as no spot in the country would be more than five miles from such a strip.

## International Air Code

Next in importance is the necessity for an Air Code for the control of private flying, similar to the Highway Code. Such a code must be concise, reasonable and written in a language which the average man can understand without having to have recourse to the horrible expedient of carrying a fat, parasitical legal man around with him to keep him on the straight and narrow path. These rules should aim only at protecting the general public, and not the pilot from himself. And, what is of paramount importance, the code must be international, as private aircraft will be used to a great extent for foreign travel. A multiplicity of codes of divergent natures on the continent of Europe alone can result only in confusion, irritation, delays on journeys, and even greater troubles which may well cause a sensible, enthusiastic private owner to put a match to his machine and finish with flying for ever.

A high standard of flying must be demanded and maintained, not only in the interests of safety, but also in the national interest, if we wish to ensure that the private owner will be qualified to play a useful part in the air defence of his country in times of emergency. Civilian flying training, therefore, must be on a unified national basis, or a National Flying Training Programme must be introduced, laying down a common standard which will

not only fill a civilian need but also help satisfy the requirements of national defence. The best results can only be achieved by the creation of a Joint Civil-Military Aviation Training Committee on which the A.O.P.A. should be represented. There will be an abundance of thoroughly qualified, experienced flying instructors immediately available upon the termination of hostilities. Let us ensure that this portion of the programme is then ready.

The foregoing is a mere brief outline of the main factors which call for immediate attention if we are to get away to a good start on the right foot in the re-establishment of private flying in a manner best calculated to lay the foundations of an industry that will play an important part in our future national economy and security.

The security angle is clear; whether we believe aircraft to be a good or evil influence—and many sincerely honest people think it stinks—to neglect its full development would be maniacal, criminal folly of the worst description. It is just as much a part of our national defence as is the machine-gun or the infantryman's rifle and bayonet. We must, therefore, be a nation of airmen.

But the economics of national defence are also a matter of supreme importance. War equipment proper, such as rifles, machine-guns, tanks, cannon, military aircraft, etc., which can be used for no other purpose than war or training for war, constitute an enormous financial burden in times of peace. The cost involved, grudgingly though it is met, is regarded as a necessary evil in the form of an insurance policy. In keeping the nation in a state of preparedness for war in the air, however, we find an entirely different situation, for the simple reason that an aircraft is a practical and useful instrument of peaceful progress in our ordinary, everyday lives.

The full development of private flying will help keep a considerable portion of the great aircraft industry which has grown out of the war in flourishing being providing useful, lucrative employment for thousands of our men and women in the days of peace immediately in front of us. It will offer a wonderful new career to the youth of the nation. That industry will provide the up-to-date equipment required for sports, pleasure and business flying which will keep us in the forefront of the nations of the world as keen air-enthusiasts ready to step at short notice, should the necessity arise, into military aircraft—to the production of which it can switch overnight—in the defence of our country.

But what of the lifeblood of the industry—the market? To begin with we shall find an increased demand in the old fields of rather feeble endeavour which existed before the war: (a) the flying clubs; (b) air taxi services; and (c) privately owned sports, pleasure and touring aircraft. These, however, will represent but a small part of the immense undertaking contemplated.

New fields of private aviation activity must be explored, opened up and encouraged by every means at our disposal. In other words, Mahomet must go to the Mountain; we must go out and "sell" private aviation by proving that it represents a definite value as a practical adjunct to the conduct of the ordinary business affairs of the nation. Our slogan must be—*Time is Money. Save Time—Fly!* We must, and we can, prove to big business organisations which maintain fleets of personal motor transport for the convenience of their executives, engineers, salesmen, accountants, etc., to-day that to-morrow they will be out of date, and very much behind the times and their more wise competitors, if they do not possess also a fleet of private aircraft to speed up the work and save the valuable time of such people.

There are many other fields of endeavour in which private aircraft will prove their value. We have only to use our imagination, find them, and then go all out to develop them. There will be a market for private aircraft immediately after the war; the potential size of that market lies entirely in the hands of the aircraft industry.

First things first, however. Just as the automobile was regarded as a useless, complicated eccentricity till community action brought proper motor highways, service stations and other aids to travel, and the manufacturers brought improvements and simplicity, so will the average person regard private flying till such time as we open up the way for him by the provision of the absolute first essentials which I have attempted to deal with in this article. This work must be started NOW. We cannot afford to wait until the end of the war.

# Injuries in Light Plane Crashes

## *U.S. Research Into Their Causes : Study of C.A.B. Accident Data on High-wing Cabin Types : Flimsy Seat and Belt Fastening Criticised*

AS a result of an investigation into why and how people are killed and injured in accidents to light aircraft, the Division of Medical Sciences of the U.S. National Research Council has made a number of recommendations concerning the structure and cabin layout in the type of machine popular among private and club fliers in America. This body also urges the need for safer flying characteristics, agreeing that many manufacturers are already working towards this desirable end by developing better flying controls, lower stalling speeds and anti-spin characteristics, and says that if such improvements can eliminate the "washout" type of light aircraft accident and restrict crashes to the moderate variety, then fatalities and even serious injury can be kept to a minimum through elimination of avoidable hazards to personnel in the event of accident. "The result of this investigation," says the report, "encourages the hope that popular light aircraft flying of the future can be made relatively safe."

The report is a preliminary one and covers 30 accidents considered "survivable." Data were provided by field investigations carried out in each case by C.A.B., and every aircraft involved was a high-wing cabin two-seater of the tandem type, and with "stick" control.

The really important conclusion reached after studying the available data is that the force of most light aircraft accidents is well within the limits of physical survival. This finding is based on the fact that a high proportion of injuries at present severe or fatal result from mechanical causes which could be modified or even eliminated. In other words, many of those severely injured or killed in the 30 accidents investigated would not have been so, had the aircraft been differently designed and constructed. For example, it is pointed out that, next to the progressive structural collapse of the forward part of the fuselage, the outstanding cause of severe injury is the instrument panel; tube clusters adjacent to the panel also account for extremely severe injuries. "The constancy of severe or fatal head injury from striking the instrument panel—without other injury to the body—suggests that any improvement in the structure of the panel would give an important increase in safety." Suggestions in this respect include increasing the space between the forward structure of the fuselage and the panel, and/or between the panel and the occupants, the idea being to put a shielding distance between the occupants' heads and the solid forward structure so that the panel would serve to protect their heads from fatal blows.

The failure of seat belts and the fastenings of the seats themselves are also involved in the problem of saving the occupants' heads from coming into violent contact with the instrument panel or the forward structure of the aircraft in a crash. Breakage of seat belts occurred in 43 per cent. of the crashes investigated and failed to hold 30 per cent. of the persons involved. Adverse comment is also

## INJURIES IN LIGHT PLANE CRASHES

made on "the flimsy structure of seats," and the report states that "improvement of materials and fastenings used in seats is an important safety need. The number of demolished seats and the tearing free of seat fastenings suggests that tests under static loadings are no criteria of true safety needs."

As regards seat belts, their present fastenings are condemned as inadequate, and the opinion is expressed that injuries might have been less severe had they not given way. Even so, it is pointed out that mounting evidence from army and navy studies indicates that restraint for the upper part of the body is the primary and most effective defence against injury in survivable accidents. In short, the ordinary seat belt commonly used on light aircraft does not prevent the wearer from being swung forward (to strike his head against the instrument panel), and that shoulder harness of some kind is required.

Some kind of inexpensive, corrugated flooring material which will not buckle and splinter under twisting strains is also needed, says the report, and it is further suggested that the squab of the front seat (in tandem seating) should be padded and arranged to pivot and move forward beyond the swing of the rear passenger's head under conditions of strong frontal force—under crash conditions, that is. Serious injuries have been caused to the occupant of the rear seat by the squab of the current form of front seat.

No suggestions are made in respect of control columns, but whether this is because the study did not disclose any serious threat from the "stick" in the crashes investigated is not indicated. Reference is made, however, to control wheels (although they do not really come within the report's terms of reference), and attention is called to the outstanding severity of injuries from wheel installations. Some material other than cast aluminium and similarly brittle substances is recommended, one suggestion being the use of a dish-shaped wire or sheet-metal wheel with rubber covering as a means of modifying the severity of present control-wheel injuries.

Other recommendations include the strengthening of engine-bearers and longerons, and the incorporation of a simple built-in accelerometer to register the peak force of any accident to provide data on which to judge the safety or hazard of the structure involved.

A final paragraph mentions the desire for more speed as being responsible for a trend among certain manufacturers of light aircraft to produce a less safe type of machine than others. "We feel," the investigators conclude, "it is in the best interests of all concerned, especially as regards light aircraft for popular use, to emphasise safety factors even at the cost of some reduction in the speed of the aircraft."

An interesting report that should repay close study.

# Pathfinders

## *A Club to Ensure Wartime Specialists Do Not Lose Touch*

IT would be difficult to assess accurately in terms of strategic value the work done in this war by the Pathfinder Group of the Royal Air Force. That their skill has been of the very greatest benefit to the effectiveness of the air war is obvious to anyone. It would be a great pity if all this accumulated experience were to be scattered to the four winds when peace comes, and in order to ensure that members of this splendid force do not lose touch with each other a club has been formed under the title The Pathfinder Club. Membership is open to all officers and aircrews who served in No. 8 Pathfinder Group. Others may be admitted if approved by the committee.

Here, it would seem, is a fine opportunity for some of our wealthy citizens or firms to do a tremendous amount of good by giving financial support. The objects of the club are set out below, and to them we need add little beyond the obvious fact that the keeping together of these specialists, whose particular qualifications will be a national asset after the war no less than during the war, is greatly to be desired.

Following are the aims of the club, the president of which is Air Vice Marshal D. C. T. Bennett, C.B., C.B.E., D.S.O.

(*a*) To maintain the spirit and fellowship of the Pathfinder Force and enable members to keep in contact with each other, through a central registry

(*b*) To encourage interest in aviation and a high standard of flying similar to that which has been maintained in the Pathfinder Force

(*c*) To do everything possible to help our prisoners of war on their return to this country.

In furtherance of these aims the committee is exploring the possibilities of providing the facilities mentioned below and of obtaining the funds necessary to carry them out.

(1) Permanent club premises in London.

(2) Opportunities for participation in peacetime aviation, including the use of an airfield and aircraft at special rates.

(3) Assistance in obtaining post-war employment by setting up a Pathfinder employment bureau.

(4) The holding of periodical reunions either of the whole club or of special sections of it (e.g., squadrons).

(5) Official recognition of the club so that members may be given facilities to attend functions and demonstrations associated with military and civil aviation and activities in connection therewith.

Each member will pay an initial subscription of 10s., which will make him a permanent registered member. He is under no obligation to pay any more. Those who wished to make use of club premises or flying facilities would pay an annual subscription.

The management of the club is vested in the Committee, which was elected at the first meeting and is as follows:—

President: Air Vice-Marshal D. C. T. Bennett, C.B., C.B.E., D.S.O.
Hon Secretary: Wing Cdr. J. C. Macgown, D.F.C.
Hon. Treasurer: Sqn Ldr. P. L. Burley.
Committee: Sqn. Ldr. C. L. Yelland, Sqn. Ldr. H. Hemming, A.F.C., Flt. Lt. W. J. Rogers, Mr. J. A. Jukes.

Members or ex-members of the Pathfinder Force who wish to join the club should send their names, together with their temporary and permanent addresses and the initial subscription of 10s., to Wing Cdr. J. C. Macgown, D.F.C., R.A.F., Huntingdon, or to any committee member.

### NO MORE N.Z. AIRMEN FOR EUROPE

FURTHER steps in the reorganisation of the Royal New Zealand Air Force following the improved war situation in Europe were announced by the Defence Minister, Mr. Frederick Jones, last week. He said the United Kingdom Government had requested that no more trainees be sent direct from New Zealand for the R.A.F.

This would entail a substantial reduction in R.N.Z.A.F. training establishments, as only a fraction of multi-engined bomber personnel previously trained for the R.A.F. could be absorbed in the Pacific.

Following advice from the United Kingdom concerning future requirements of the R.A.F., agreement had been reached involving the future concentration of R.N.Z.A.F. training for Pacific service only.

The reorganisation will involve the closing of additional Air Force stations, the amalgamation of smaller units and the releasing of 2,400 officers, airmen and W.A.A.F. or administrative and ground staffs in addition to the 1,600 released in August last.

Steps have been taken for the return home of New Zealand personnel who have served overseas with the R.A.F. for three years or more.

# CORRESPONDENCE

*The Editor does not hold himself responsible for the views expressed by correspondents. The names and addresses of the writers, not necessarily for publication, must in all cases accompany letters.*

## THEORY OF FLIGHT
### *Answer Emphatically Negative*

IT is about time some people got the idea out of their heads that an aircraft is sideslipping when flying in a cross-wind. The movement through the air is not in any way affected by the air having a movement of its own relative to the earth; therefore, the pitch or angle of attack of an airscrew blade would not be altered by a cross-wind.

If the aircraft was yawing or sideslipping the angle at which the airscrew blade met the air would vary, but if the angle was greater at one half of the arc of the blade, it would be less at the other, and the variation would cancel each other out, so the pitch of the blade would still remain the same.

The number of engines on an aircraft does not affect the problem.

F. J. B.

## DOWN-DRAUGHT CARBURETTORS
### *Fuel Entry Assisted by Gravity*

MAY I reply to the letter by H. M. Myers on down-draught carburettors, in *Flight* of Sept. 7th.

It should be realised that at any particular altitude the pressure of the atmosphere acts equally in all directions. The effects of gravity are felt only in the degree of density.

The depression set up by the supercharger impeller, and the down-moving piston will most certainly reduce the density of the mixture. This reduction would, under normal circumstances, cause the mixture to rise to a higher level. The reduction of pressure is, however, sustained and as a result, whether the down-draught or up-draught carburettors are installed, the pressure of the surrounding atmosphere at the intake, will cause the higher density air to flow into the low pressure area.

I should say that the main advantage of the down-draught type of carburettor is to be found in that the air-intake is well clear of the ground, and the possibility of the entry of mud, slush, etc., which may be thrown up when taxying, is eliminated.

One other advantage of the down-draught is that gravity will assist the entry of fuel from the delivery nozzle to the entry vanes of the impeller. The up-draught carburettor would have to counteract the effects of gravity, so far as the fuel entry was concerned. The *air* will not be adversely affected with either type.

R. F. SIMMS.

## THE RAILWAYS AND CIVIL AVIATION
### *Inappropriate Analogy*

"MOORHEN'S" reply, in your issue of August 3rd, to my earlier letter employs an analogy as elastic as any stretch of imagination could be and as inappropriate as any flight of fancy the waterlogged bird of his pseudonym has ever made. This may be a mixed metaphor, but it serves to suggest the muddled thinking now extant about railway lines and air lines.

Is it really necessary to point out to anyone who has given such matters more than superficial thought that there is no appeal to reason in comparing the production of various commodities from one material, e.g., rubber, with the operating of various public services, even if they can all be classified under the generalised headings of travel and transport? A firm may specialise and therefore excel in the production of any variety of rubber goods. But no individual or organisation can specialise and excel in serving the public competently and completely with all forms of travel, no more than a surgeon could deal expertly with all parts of the body. "Jack of all trades . . ." has been shown by the state of the canals which have by no means yet outlived their economic value to the nation. Divided interests are anathema to efficiency.

We only have "Moorhen's" word for Railway Air Services doing their wartime job "efficiently and economically." Before the war they were run by charter to Imperial Airways, who did the job for them. The difference since then is that they have gradually absorbed a number of other successful companies under a scheme of centralising (with its monopolising effect so decried by the railways and shipowners now that the Government does the same thing in the case of B.O.A.C.) of all forms of transport for war purposes.

Such things are really obvious if we allow ourselves a little disinterested thought. It was for this reason that I wished to expose the fallacy that the railway and shipping interests operating goods and passenger services on land and sea were, *ipso facto*, the best ones to handle air services also.

It points to the obvious corollary that these vested interests will then be free to develop their own particular services to a far higher standard than heretofore. There was clearly plenty of scope for this when we compared our English services with travel services operated by other countries, even before the war, without considering the present and post-war positions. Let us stick to our own jobs and make sure we are each doing these not only to the best of our particular qualifications and with the utmost initiative, but to the best that the public deserves and will surely demand if it is only given a chance to choose freely.

GEOFFREY COOPER (Sqn. Ldr., A.A.F.).

## CIVIL AIRCRAFT ENGINES
### *No Future for the Diesel*

IN reply to "Taxpayer" (*Flight*, August 31st) I had not forgotten the diesel engine for post-war civil aviation. I am of the opinion that this type of engine is not likely to be used again either for lighter or heavier than air craft.

The advent of the gas turbine promises similar advantages, both for low price fuels and fire risk.

The high-speed diesel came into its own for a short period about 16 years ago, especially for long-range work. In those days a great deal of attention was given to the diesel on account of its fire-risk advantages, but even this did not prevent the petrol engine taking the lead. This was largely due to the gradual improvement in petrol to 87 octane and then to 100 octane.

Another problem was the manufacture of a fuel with a low freezing point and good octane value. With the advantages now gained by using high octane fuel, it is doubtful if, on this point alone, the diesel will catch up even with its high thermal efficiency.

Although the diesel cannot give the rich mixture requirements as can that of the petrol engine for take-off, there are methods for assisting take-off which could be used, but I consider this is more of a drawback than an asset.

There seems to be only one really good application for the diesel, and that is for heavy transport road vehicles. I am, of course, not taking into account marine power, where there is a wide scope.

C. H. POTTS.

## POST-WAR OWNER PILOTS
### *A Playful Tilt at "Deck Hook"*

IT is really remarkable how the genus "Deck-Hook" (*Flight*, September 14th) survives after having been wrong on so many occasions and in so many centuries. One can imagine his woad spots glistening with indignation as he chiselled off a letter to the *Cave Dwellers Clarion* on the lethal possibilities of the newly invented wheel. Wheels, he no doubt pointed out, go round and round and no forest path will be safe from now on.

"Deck-Hook" struck a leanish period after that until the lunatics and madmen invented bicycles and started putting steam engines in carriages and ships. Probably his finest chance to date has been the motor car, which terrified him into print at the end of the last century, and apparently still provides him with a horrific thrill.

And here he is popping up again as fresh as a daisy and as dismal as an air-raid warning. Realising once again that only he has that clarity of mind which enables a true picture of the future to be seen, and ignoring the fact that he has always been wrong in the past, he unwinds his jeremiad in typical manner and makes his youth-curbing glutinous recommendations, which, had they been regarded, could have halted all progress at any given stage in the past.

Fortunately no one ever pays much attention to "Deck-

# CORRESPONDENCE

Hook," and so we will get our post-war "aerocar" in whatever form and under whatever control common sense decrees.

Incidentally, "Deck-Hook" has chosen a singularly appropriate nom de plume, and in contra-distinction I would like to sign myself "Sky-Hook," only I don't see any point in the anonymity.

J. S. POLE.

## BOMB BLAST

### *Wave-form Highly Asymmetrical*

I HAVE read with great interest Mr. Maxwell Smith's elegant criticism (*Flight*, August 3rd) of several letters which have lately appeared under the above heading in the technical Press. In his concluding paragraph he asks whether there is any evidence that the speed of sound in air is greater at very high amplitudes. This is a subject on which volumes could be and have been written. To summarise briefly, it has been established by evidence, if not in theory, that:—

(1) The velocities at which sounds of high amplitude are propagated exceed the velocity of normal sound waves, at least in the initial stages.

(2) In the case of explosions the velocity varies according to the origin as well as according to the intensity of the explosion; thus a different velocity is to be expected from the blast of a high-velocity gun than from a stationary explosion, an effect analogous to the Doppler Effect.

An interesting feature of blast wave-form that I have observed, and that has been confirmed by more eminent authorities, is that the wave-form is highly asymmetrical, the compression portion of the wave being of very short duration and therefore of high amplitude, whilst the rarefication portion is of comparatively long duration and consequently of lower amplitude. The impact of a wave-front of this type on a large plane surface is liable to produce fracture but the period of compression is not long enough (being measured in milliseconds) to overcome inertia and give the broken surface momentum in the direction of propagation of the sound, whereas the rarefication portion of the wave, with its much longer time of application and unspent energy, gives the already shattered material a limited movement in the reverse direction, *i.e.*, towards the source of the blast. This explains why under normal conditions the glass from "blasted" windows flies outwards. Abnormal cases can be attributed to a variety of causes in all of which reflected sounds predominate.

It should be borne in mind that the equation for the velocity of sound is based upon the assumption that the amplitude is very small in comparison with the wavelength, whereas in the case of "blast" the amplitude is by no means negligible. A theoretical formula was developed by Dr. Rieman in which the velocity $V_E$ at a distance X was equal to $V_S \sqrt{\frac{1+K}{X^2}} V_S$ being the normal velocity of sound and K a factor depending on the condensation. It is recorded that explosive charges give results fairly consistent with the above equation. In my opinion there is still much to be studied and explained, but the solution of the problem lies in the correct interpretation of the asymmetrical wave-form which seems to characterise these high amplitude sound waves. The "restoring force" is, in the initial stages, inadequate to produce stable conditions and presumably constant velocity is only achieved when the wave-form becomes symmetrical.

The most notable experiments that come to my mind are very fully described in Dr. Dayton Miller's book on "Sound Waves, their shape and speed." From his experiments, carried out officially in conjunction with the U.S.A. Ordnance Department, emerge the facts that very high initial velocities were recorded, which appeared to decrease more or less exponentially (not in accord with the Riemann Equation). The greatest velocity of sound which was recorded was just above that of the projectile and was about 2,500 feet per second, but the velocity had decreased to the normal velocity of sound when recorded at a thousand feet from the source. An interesting conclusion arrived at by Professor Miller is "that the virtual source of the sound and the centre of the developing wave-front in its beginnings, are in effect shot out of the gun, at a speed which may be in excess of that of the projectile itself. The speed of this expanding sphere is rapidly damped by the atmosphere, and its advance is reduced exponentially to a zero value."

It seems to the writer that research on a grand scale becomes imperative before our architects and builders are "let loose" on any grandiose scheme of house planning.

Modern electronic equipment, capable of measuring in microseconds the duration of a nearby or distant flash and the interval between the flash and its accompanying sound effects, should do much towards solving the problem.

A. G.

# BOOK REVIEWS

*"The Mediterranean Fleet; Greece to Tripoli." The Admiralty Account of Naval Operations April, 1941, to January, 1943. H.M. Stationery Office. 1s. 6d.*

BEAUTIFULLY illustrated with reproductions of paintings by Lt. Cdr. Rowland Langmaid and of photographs, this brochure carries on the story which was begun in *East of Malta, West of Suez*, and gives the record of the Mediterranean Fleet during the campaigns in Greece and Crete, Wavell's retreat and Auckinleck's advance and retreat in Libya. It ends with the victorious advance of Montgomery and the occupation of Tripoli.

It is a grim and glorious story, and we very much doubt whether the British public has ever realised what the British losses in ships were at this darkest moment of the history of British sea power in the Mediterranean. The record of ship after ship being sunk almost turns the reader sick; but this feeling is soon succeeded by a thrill of admiration at the way in which the work was never let down. Crete was a great naval triumph, despite the heavy losses in ships. Every man knew the risks, and most had had ocular demonstrations of them, but there was no faltering by either Royal Navy or Merchant Navy. Very many of the ratings were "hostilities only" and many of the officers came from the R.N.V.R.

Despite its losses at Taranto, the Italian Navy was still potentially very powerful, but one gets the impression that the Royal Navy never took it very seriously. The villain of this piece was the *Luftwaffe*, aided by submarines. In the main the naval struggle was between ships unprotected by an air cover and aircraft working on their own account. One feels that had the ships not been British the air would have won, and would have dominated the Mediterranean; but the British seamen refused to admit that anyone or anything was their superior, and continued to perform their indispensable tasks. At one time it seemed just touch and go; but Alamein changed the whole position, and the Army conquered airfields from which the R.A.F. could give cover to the ships, which, in turn, supplied both the other Services.

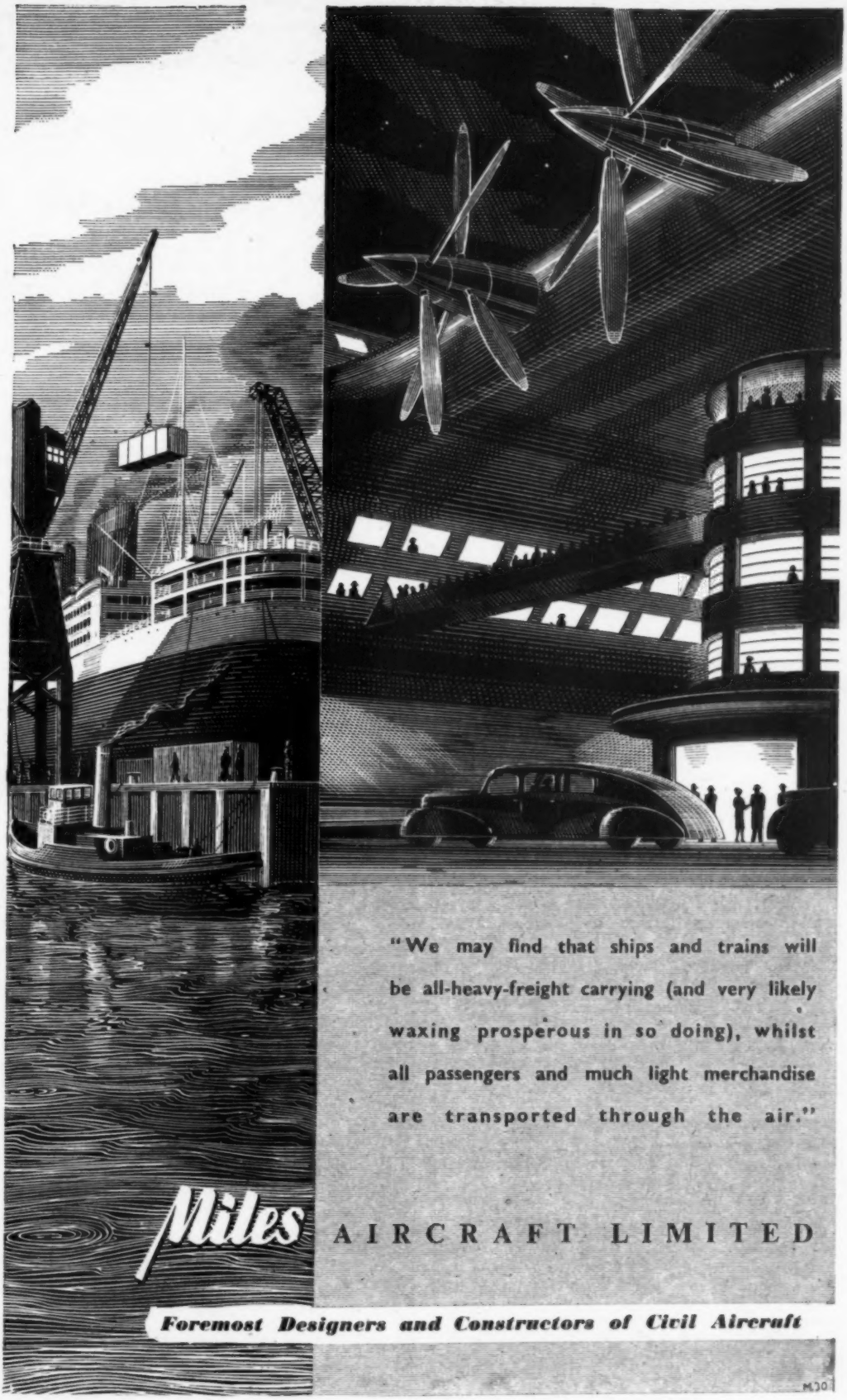
Every Briton ought to read this book.

*Keep the Peace Through Air Power. By Allen A. Michie. Henry Holt and Co., 257, Fourth Avenue, New York.*

THIS is a rather strange book. In the main it is very interesting, and yet it is a muddled compilation. Many pages are devoted to explaining clearly and convincingly how and why the Allies lost the peace after 1918. Then it works up to the argument which justifies the title of the book, and then it goes back, as it were, to discuss methods of dealing with Germany and Japan after they have been defeated, *e.g.*, by education or partition, or otherwise.

*Flight*, naturally, is mainly interested in the writer's views on air power. In the first chapter he asserts that "we are certain to conclude that the air power of the Allies played a decisive, if not *the* decisive rôle in the winning of this war." Most observers, we believe, will conclude that it was the way in which land, sea and air all worked together which played the decisive part.

For preventing the aggressor nationals from rearming after the Armies of Occupation have withdrawn, the writer believes that air power (*i.e.*, a bomber force) exerted at first by the Big Four victors (incidentally, he seems to have forgotten that Russia is not at war with Japan) on the lines used by the R.A.F. in keeping the peace in Iraq and the Aden Hinterland, will be the most effective instrument. He has studied R.A.F. methods carefully, and his exposition of them is likely to have a good effect in the United States and elsewhere. But his contention that these methods could be applied to Germany and Japan—applied, be it noted, by three or four victor Powers sitting as a court of justice—are not convincing. The Ruhr does not resemble the Aden Hinterland, and methods which are successful when applied by one controlling authority may well prove abortive when the order to take air action must be given by a court made up of several different nationalities. Even if the court could be trusted to act with the necessary promptitude, we do not feel convinced that a bomber force would be the most effective weapon. We should put greater trust in an airborne Army.



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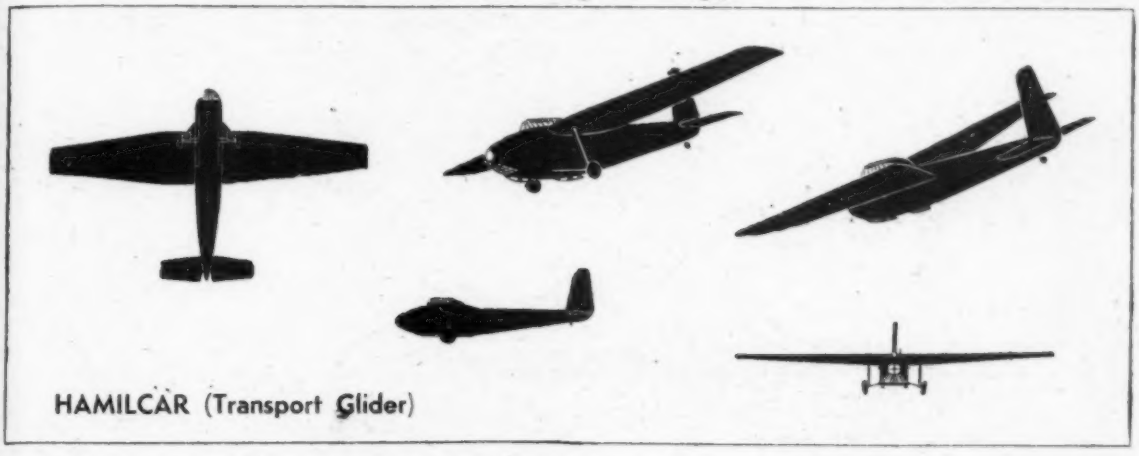
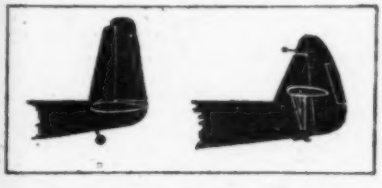
# Aircraft in Flying Attitudes



HAMILCAR (Transport Glider)

THE Hamilcar heavy transport glider, produced by General Aircraft, first went into action when it carried tanks to reinforce the British Sixth Airborne Division in Normandy. The airborne arrival of these light tanks, which weigh round about 7 tons, is reported to have taken the Germans completely by surprise, for the existence of the Hamilcar had been a well-kept secret, which is a very good answer to those correspondents who have written to *Flight* accusing the A.T.C. of careless talk; thousands of A.T.C. cadets had known about the Hamilcar for months before D-Day.

The element of surprise was, moreover, fully exploited by the speed with which the tanks went into action, for the method was to start up the engine while the Hamilcar was making its final approach to the landing ground. When the big glider touched down the tank's crew were "all set," so that the moment their carrier came to rest, the nose was swung open and the tank was driven straight out.

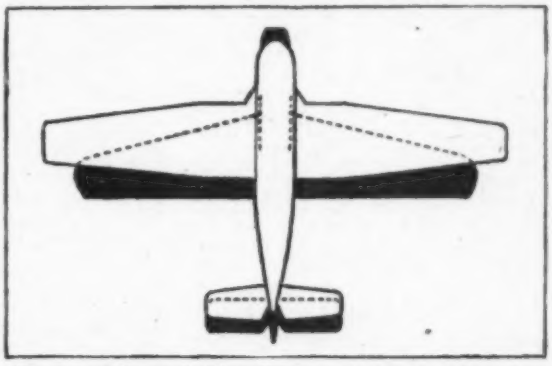


The Hamilcar (left) has very tall, tapered fin and rudder with low-set cantilever tail-plane. The Horsa (right) fin and rudder is more conventional.

In general appearance the Hamilcar bears a family resemblance to its much smaller brother, the G.A. Hotspur training glider, particularly in its very tall, high aspect-ratio fin and rudder, but these two are so vastly different in size that there could be no possibility of confusing them. For purposes of comparison, therefore, the Hamilcar is here pictured with the Airspeed Horsa transport glider, and the superimposed silhouettes in the adjoining column show that although the Hamilcar has the greater wing-span its overall length is slightly less than that of the Horsa.

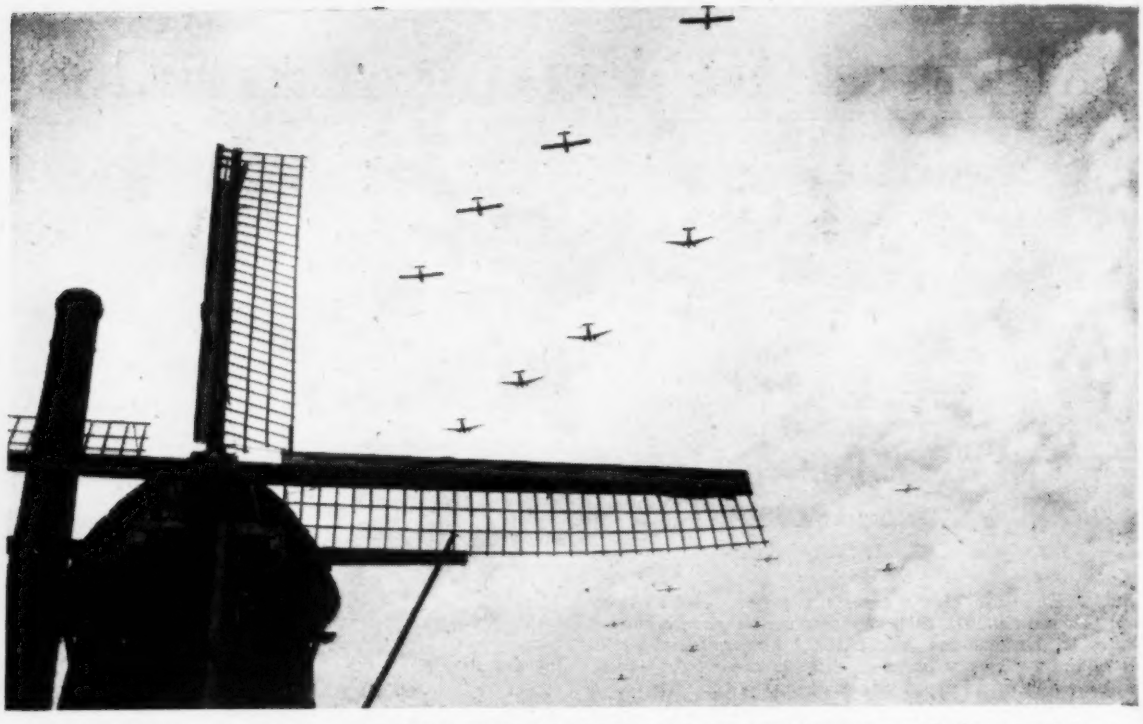
Major differences between these two British heavy transport gliders will readily be seen in these drawings and photographs. The Hamilcar's wings taper on both edges from a rectangular centre-section, whereas those of the Horsa have a backswept leading edge and straight trailing edge, their tips being square and raked respectively. The fuselage of the Hamilcar is almost rectangular in cross-section as against the circular sectioned fuselage of the Horsa. The Hamilcar also has a raised cabin-top beneath which the pilot and one other of its crew are seated in tandem. Dimensions of the Hamilcar are: Span 110ft., length 68ft., height 26ft. 3in

General Aircraft Hamilcar heavy transport glider. This head-on view, as seen from its tug, shows the almost square-sectioned fuselage and raised "office." The undercarriage can be dropped after take-off.



These superimposed silhouettes serve to contrast the wing plan of the Hamilcar (greater span) with that of the Horsa. Note the latter's greater overall length and longer nose.

Airspeed Horsa.



DOUBLE DUTCH : Waco CG-4A gliders with their Douglas Dakota tugs pass over Vakkenswad near Eindhoven on their way to reinforce previous airborne landings.

# SERVICE AVIATION

## *Royal Air Force and Fleet Air Arm News and Announcements*

### *Appointments*

Air Comdre. A. L. FIDDAMENT, C.B.E., D.F.C., to be Senior Air Staff Officer, H.Q., Transport Command, and to be Act. Air Vice-Marshal.

Air Comdre. J. G. MURRAY to be Air Officer Commanding a Group in Balloon Command.

Air Comdre. P. L. LINCOLN, D.S.O., M.C., to be Senior Air Staff Officer and Air Officer in Charge of Administration, Balloon Command.

Group Capt. E. F. WARING, C.B.E., D.F.C., A.F.C., to be Director of Flying Control and Rescue, Air Ministry, and to be Act. Air Commodore.

Group Capt. F. J MANNING to be Director of Organisation (Establishments), Air Ministry, and to be Act. Air Commodore.

### *Awards*

THE KING has been graciously pleased to approve the following award in recognition of distinguished services :—

**Distinguished Service Order**

Capt. R. B. PAIM, S.A.A.F., No. 94 Sqn.

THE KING has been graciously pleased to approve the following awards in recognition of gallantry displayed in flying operations against the enemy :—

**Distinguished Service Order**

Wing Cdr. G. R. A. McG. JOHNSTON, D.F.C., R.A.F.V.R.—Wing Cdr. Johnston is an outstanding leader, whose rare qualities of skill, bravery and devotion to duty have been well reflected in successes of the squadrons he commands, which have, within a few months, destroyed 57 enemy aircraft and damaged many more. Within a short period Wing Cdr. Johnston himself has shot down four enemy aircraft. His example has inspired all.

Wing Cdr. D. C. SMYTHE, G.M., R.A.F.O., No. 178 Sqn.—Since this officer has commanded his squadron it has been engaged on bombing and mining operations in the Middle East. By his outstanding leadership and untiring devotion to duty Wing Cdr. Smythe has greatly assisted in building up its fine record of achievements. In December, 1943, he led a mining operation and, despite extremely accurate opposition, succeeded in laying the mines in the correct position. Much of the success was owing to his inspiring leadership. Wing Cdr. Smythe has completed one tour of operational duties and is now on his second. His enthusiasm, ability and gallantry have merited the highest praise.

Sqn. Ldr. G. J. BLACK, D.F.C., R.A.F.V.R., No. 250 Sqn.—Sqn. Ldr. Black has completed two tours of operational duty. He has taken part in attacks against targets in Syria, the Western Desert, Tunisia, Malta, Sicily and Italy. His leadership at all times has been daring and skilful, and by his courage in the face of intense and accurate anti-aircraft fire he has set an inspiring example. He has completed many low-level attacks with great determination and precision, while, owing to his fine navigational ability, his squadron have been able to locate well-camouflaged enemy targets. While under his command the squadron has destroyed much enemy mechanical transport and railway trucks, and caused severe damage to many bridges and sections of railway lines.

Sqn. Ldr. J. BROTHERTON - RATCLIFFE, R.A.F.V.R., No. 148 Sqn.—This officer has completed a large number of operational sorties during which he has displayed outstanding determination to complete his missions, regardless alike of enemy opposition or adverse weather. He has on more than one occasion continued to the target and completed an operation after one engine of his aircraft had failed. In December, 1943, Sqn. Ldr. Brotherton-Ratcliffe was forced to leave his aircraft by parachute and, early in this year, he was involved in a very serious crash. Despite these harassing experiences, his keenness for operational flying is undiminished, and by his skill, courage and devotion to duty this officer has set an inspiring example to all.

Col. L. A. WILMOT, D.F.C., S.A.A.F.—This officer has been employed on active operations against the enemy for a long period. In 1943 he completed numerous sorties, which included arduous fighter operations over the Salerno landing beaches. While under his command his Wing has taken part in many successful anti-shipping sorties, attacks on enemy road and rail transport and bombing missions in support of our land forces. Col. Wilmot has led the wing on many of their more difficult tasks. In April, 1944, he was in command of the sortie on which the Pescara dam was destroyed. Later, in May, 1944, Col. Wilmot also led a brilliant attack on gun emplacements in the Piedmonte area. His personal example, courage and devotion to duty have been largely responsible for the Wing's outstanding results.

Wing Cdr. J. SIMPSON, D.F.C., R.A.F.V.R., No. 97 Sqn.—Wing Cdr. Simpson has displayed rare qualities of skill, bravery and devotion to duty. He has completed a very large number of sorties, most of them against well-defended targets important to the enemy's war effort. His skill and determination throughout have earned him much success.

Wing Cdr. R. KINGSFORD-SMITH, D.F.C., R.A.A.F., No. 463 (R.A.A.F.) Sqn.—Since being awarded the D.F.C., this officer has completed numerous sorties, several of which have been against targets in the Normandy area. He has displayed exceptional skill and the determination to complete his missions successfully has been amply demonstrated on many occasions in the face of heavy anti-aircraft opposition and fighter interference. He is a brilliant leader whose outstanding ability, untiring efforts and iron determination have contributed in a large way to the high morale and operational efficiency of the squadron.

Wing Cdr. A. W. DOUBLEDAY, D.F.C., R.A.A.F., No. 61 Sqn.—This officer has completed very many sorties on his second tour during which he has attacked such targets as Berlin, Brunswick and Leipzig in Germany and other targets in Northern France. He has displayed high qualities of leadership, great courage and unbeatable determination, and much of the success of the squadron he commands can be attributed to his fine qualities which have inspired all. Both in the air and on the ground he has set an example of the highest order.

Sqn. Ldr. C. B. MORTON, D.F.C., R.A.F.V.R., No. 101 Sqn.—This officer has completed many successful sorties since being awarded a Bar to the D.F.C. He is a magnificent leader, whose fine fighting spirit and gallant example have inspired all. Sqn. Ldr. Morton has displayed a rare zest for operations, and his successes are an excellent testimony to his great skill, resolution and devotion to duty.

Sqn. Ldr. H. F. BREAKSPEAR, D.F.C., R.A.F.V.R. —This officer has completed very many sorties,

# SERVICE AVIATION

during which he has attacked Berlin on eleven occasions. Within recent months Sqn. Ldr. Breakspear has led his flight on numerous sorties against targets in the battle area in Normandy. By his careful planning and great skill he has played a good part in the success achieved. He is an inspiring leader, whose outstanding qualities have contributed materially to the efficiency and fine fighting spirit of the flight he commands.

Sqn. Ldr. B. W. CULPIN, D.F.C., R.A.F.V.R., No. 405 (R.C.A.F.) Sqn.—This officer has participated in a very large number of sorties, including sixteen attacks on the German capital. He has set a splendid example of keenness and devotion to duty. In addition to his operational tasks, Sqn. Ldr. Culpin has devoted much skill and energy in training other members of the squadron with good results.

Sqn. Ldr. E. D. LEVIEN, D.F.C., No. 90 Sqn.—This officer has completed a second tour of operations and has continued to display the highest qualities of skill, courage and leadership. He has at all times displayed the greatest determination in pressing home his attacks and has achieved much success. He is a most efficient and understanding captain, whose unfailing devotion to duty has set a fine example.

Sqn. Ldr. J. R. MCDONALD, D.F.C., R.C.A.F., No. 405 (R.C.A.F.) Sqn.—Since being awarded the D.F.C., this officer has completed very many sorties against a wide range of targets. He has displayed a high degree of skill, keenness and determination throughout and his example has been most inspiring. He is a very efficient and zealous flight commander and has rendered extremely valuable service in the training of other members of the squadron.

Sqn. Ldr. A. J. MULLIGAN, D.F.C., R.A.F.V.R., No. 156 Sqn.—This officer has completed a very large number of sorties, involving attacks on heavily defended areas in Germany and on other more distant targets. He has at all times displayed great determination and devotion to duty. He has rendered exceptional service and has proved himself a great asset to the squadron.

Flt. Lt. R. EDWARDS, R.A.F.V.R., No. 7 Sqn.—This officer has completed a very large number of sorties, involving attacks on a wide range of targets in Germany; he has also completed several bombing missions against targets in Normandy. He is a highly skilled and fearless captain and pilot, whose fine fighting qualities have been reflected in the efficiency and determination of his crews.

Flt. Lt. H. B. HAY, D.F.C., R.C.A.F., No. 692 Sqn.—This officer has participated in a very large number of sorties, involving attacks on a wide variety of enemy targets. He has invariably displayed a high standard of courage and resolution. He has rendered much loyal and devoted service.

F/O. N. R. ROSS, D.F.C., R.A.F.V.R., No. 617 Sqn.—This officer has completed a very large number of sorties and the successes obtained are a fine testimony to his great skill, courage and resolution. He is a model captain, whose strong sense of duty, gallantry and resource has set an example of the highest order.

Wing Cdr. M. E. POLLARD, D.F.C., A.F.C., R.A.F.O., No. 107 Sqn.—This officer has led numerous successful attacks against enemy airfield military installations, convoys and lines of communication. More recently, since the invasion of France, he has completed six particularly harassing patrols at night over Normandy and in addition has led six aircraft in an attack on enemy fuel trains at Chatellerault. In spite of the darkness the trains were located and a telling low-level attack delivered. Throughout, Wing Cdr. Pollard has set a splendid example of courage and leadership.

Sqn. Ldr. F. M. GOODALE, R.A.F., No. 16 Sqn.—This officer has a fine record of operational flying. He served in France in 1940 and took part in the Dieppe operation in 1941. Since then he has flown on numerous photographic reconnaissances. Throughout this long period Sqn. Ldr. Goodale has proved to be an outstanding leader who has constantly set a fine example of keenness, resolution and skill.

Wing Cdr. E. H. MCHARDY, D.F.C., R.A.F.O., No. 143 Sqn.—Wing Cdr. McHardy is now on his third tour of operational duty and has completed numerous sorties. He possesses very marked powers of leadership which have been reflected in the excellent morale and enthusiasm which has permeated his squadron. While in command of the squadron, he took part in eleven anti-shipping operations, four of which developed into major and successful attacks on enemy vessels. Wing Cdr. McHardy has destroyed at least three enemy aircraft and damaged others.

Sqn. Ldr. C. G. CLEGG, R.A.F.O., No. 159 Sqn.—Sqn. Ldr. Clegg is an outstanding operational pilot who has been employed on operations without a break since May, 1941. In the United Kingdom and the Middle East theatres of war he participated in numerous night fighter and intruder patrols and, during that period, destroyed at least four enemy aircraft. Since joining this squadron as flight commander, he has completed his duties in a most able and skilful manner. He has completed a number of successful night bomber sorties over Burma and has twice flown his aircraft and crew safely to base on three engines after sustaining damage in combats with enemy fighters.

Sqn. Ldr. D. R. M. FURNISS, D.F.C., R.A.F.V.R.—This officer has completed a tour of duty on photographic reconnaissance work. In February, 1944, he commanded a photographic reconnaissance detachment which flew to North Russia in connection with the attack on the German battleship *Tirpitz*. Despite treacherous weather and persistent technical failures due to the intense cold, the detachment took part continuously in reconnaissance work. Sqn. Ldr. Furniss participated in all the work of the detachment and obtained many photographs despite enemy opposition.

Sqn. Ldr. G. D. S. KOESTER, D.F.C., R.C.A.F., No. 105 Sqn.—This officer has displayed the highest standard of courage and determination in air operations. He is a highly skilled member of aircraft crew, whose great skill and devotion have played an important part in the success achieved. His record is most impressive.

## Bar to Distinguished Flying Cross

Wing Cdr. J. B. MILLWARD, D.F.C., R.C.A.F., No. 405 (R.C.A.F.) Sqn.—Wing Cdr. Millward has completed many successful sorties during which he has attacked a wide range of strongly defended targets. He is an exceptionally keen and capable flight commander and has at all times displayed fine qualities of courage and devotion to duty.

Wing Cdr. W. F. M. NEWSON, D.F.C., R.C.A.F., No. 431 (R.C.A.F.) Sqn.—Wing Cdr. Newson has shown marked ability both as a squadron commander and as a captain of aircraft on operations. Since the award of the D.F.C., he has completed attacks on such targets as Berlin, Magdeburg, Stuttgart and Dusseldorf in a most gallant and efficient manner. His courage, leadership and resolution have set a fine example to all.

**SKIPPER'S BADGE: Captains of aircraft crews in Bomber and Coastal Command can now wear a distinguishing armlet. It is a capital C surmounted by an eagle and crown.**

Flt. Lt. T. W. PIERCE, D.F.C., R.C.A.F., No. 105 Sqn.—This officer has completed many sorties against a variety of targets and has set a fine example of skill, courage and tenacity. A navigator of considerable experience, with a fine operational record, Flt. Lt. Pierce is an invaluable officer to his squadron.

Flt. Lt. J. F. LEWIS, D.F.C., R.A.F., No. 405 (R.C.A.F.) Sqn.—This officer has flown on a great number of sorties against strongly fortified targets in Germany. His technical skill and keenness for operational flying have set a fine example to the rest of his crew.

Sqn. Ldr. T. W. HORTON, D.F.C., R.N.Z.A.F., No. 105 Sqn.—Since his previous award Sqn. Ldr. Horton has completed many successful sorties, during which he has attacked a wide range of targets. He has on all occasions shown great courage and determination and has done much valuable work.

Flt. Lt. H. C. WILLIAMS, D.F.C., R.N.Z.A.F., No. 7 Sqn.—Since being awarded the D.F.C., Flt. Lt. Williams has completed many more operational sorties. A most determined and courageous captain of aircraft, he is undismayed by heavy opposition and always presses home his attacks with skill and courage. He has several times been subjected to determined attacks by enemy fighters which have been frustrated through his skilful airmanship, and on two occasions at least his gunners have been enabled to destroy the enemy aircraft.

Flt. Lt. G. W. A. AUSTEN, D.F.C., R.A.F.V.R., No. 640 Sqn.—Since being awarded the D.F.C., this officer has completed many sorties and has continued to display the highest standard of skill and gallantry. Recently he was the rear gunner of an aircraft detailed to attack the railway sidings at Amiens. During the operation his aircraft was attacked by a fighter. Flt. Lt. Austen promptly gave his pilot the necessary combat manœuvre and then opened fire. His bullets struck the attacker which is believed to have been destroyed. On this, as on other occasions, Flt. Lt. Austen defended his aircraft with great skill, and thus contributed materially to its safe return.

Flt. Lt. B. G. FROW, D.F.C., R.A.F.V.R., No. 7 Sqn.—One night in June, 1944, these officers and warrant officer were captain, rear gunner and midupper gunner respectively of an aircraft detailed to attack an enemy target. When nearing the enemy coast on the return flight, Flt. Lt. Frow saw a Ju 88 about to attack another aircraft of the bomber force. He immediately ordered his gunners to open fire. Flt. Lt. Wharton and W/O. Erasmus promptly delivered bursts of fire which struck the enemy aircraft, causing it to dive to the ground where it exploded. A few minutes later Flt. Lt. Wharton sighted another fighter coming in to attack. He quickly warned his captain who manœuvred to a good position from which Flt. Lt. Wharton delivered a long burst of fire. His bullets struck the attacker which caught fire and dived earthwards. In the meantime, W/O. Erasmus had sighted yet a third fighter on the starboard quarter. Although the intercommunication system was defective he managed to warn his captain and co-gunner and the latter drove off the attacker which had closed in. These members of aircraft crew displayed great skill, coolness and co-operation throughout this notable action. They have completed many sorties against dangerous and difficult targets.

Flt. Lt. M. M. DAVISON, D.F.C., R.A.F.V.R., and F/O. A. C. WILIMOTT, D.F.C., R.A.F.V.R., both of No. 264 Sqn.—As pilot and observer respectively these officers have completed a very large number of sorties and have invariably displayed praiseworthy courage and devotion to duty. They have destroyed ten enemy aircraft, successes which are an excellent testimony to their skill and co-operation.

Flt. Lt. J. F. MCELROY, D.F.C., R.C.A.F., No. 421 (R.C.A.F.) Sqn.—This officer continues to display the finest qualities of courage and determination in air operations. In June, 1944, he flew the leading aircraft of a formation which engaged a force of more than 30 enemy fighters, nine of which were shot down. Although his aircraft sustained severe damage, Flt. Lt. McElroy made a safe landing at an airfield. In this engagement he displayed leadership of a high order.

Flt. Lt. R. F. HAYES, D.F.C., R.A.F.V.R., No. 293 Sqn.—This officer has done outstanding work on air/sea rescue sorties. On one occasion he was largely responsible for saving the life of a pilot off the Albanian coast. During the rescue his aircraft was attacked by three Me 109s and destroyed. Flt. Lt. Hayes and his colleagues escaped ashore and were rescued later by another Air/Sea Rescue aircraft. In May, 1944, Flt. Lt. Hayes made a gallant attempt to rescue a fighter pilot whose aircraft had been forced down on to the sea near the enemy coast. While he has been in command he and his crews have saved the lives of many members of air crew.

Wing Cdr. W. P. PLEASANCE, D.F.C., R.C.A.F., No. 419 (R.C.A.F.) Sqn.—One night in June, 1944, these officers were pilot and flight engineer respectively of an aircraft detailed to attack the railway junction at Versailles. In the take-off both the port engines faltered at a time when the aircraft had barely left the ground. Wing Cdr. Pleasance was unable to climb, but, by just clearing immediate obstacles and by taking advantage of low flying ground, he flew on for some 20 miles at a height of about 200 feet. By then P/O. McGill had succeeded in restoring power to the engines, and Wing Cdr. Pleasance flew on to the target and bombed it. Both these officers displayed great coolness and skill in a difficult and dangerous situation.

Wing Cdr. C. S. BARTLETT, D.F.C., R.A.F.O., No. 434 (R.C.A.F.) Sqn.—In the course of his second tour of operations this officer has attacked many strongly defended targets, including several attacks on Berlin and numerous others on industrial centres in the Ruhr. He is a forceful and courageous leader whose example has inspired all.

Flt. Lt. A. E. UMBERS, D.F.C., R.N.Z.A.F., No. 3 Sqn.—This officer has led his flight on very many sorties during which military transport, railway communications, ammunition dumps and other targets on the ground have been attacked with excellent results; on one occasion eight locomotives were destroyed. By his great skill and unbeatable determination, Flt. Lt. Umbers has played a worthy part in the successes achieved. He is a most inspiring leader.

Wing Cdr. F. A. GREEN, D.F.C., R.A.F.O., No. 105 Sqn.—Since being awarded the D.F.C., this officer has participated in many more operational sorties the majority of which have been against the enemy's most vital and strongly defended targets. He has at all times displayed a fine fighting spirit, and under his experienced leadership his flight has achieved many successes.

Sqn. Ldr. E. F. CAWDERY, D.F.C., R.A.F.O., No. 97 Sqn.—Since being awarded the D.F.C., this officer has taken part in sorties against some of the most heavily defended targets in Germany and occupied territory. He has continued to display resourcefulness and courage, which, coupled

with his determination to press home his attacks, have set an inspiring example to all.

Sqn. Ldr. J. F. WILLS, D.F.C., R.A.F.V.R., No. 105 Sqn.—This officer is an efficient and capable captain of aircraft, who has performed his duties with courage and coolness of a high order. Since the award of the D.F.C. he has completed a second tour of duty, achieving outstanding results. He has displayed courage, judgment and outstanding ability throughout his whole operational career.

### Distinguished Flying Cross

Flt. Lt. E. WHARTON, D.F.M., R.A.F.V.R., and W/O. O. G. ERASMUS, R.A.F.V.R., both of No. 7 Sqn. For citation see Flt. Lt. Frow, D.F.C. and Bar.

P/O. M. D. McGILL, R.C.A.F., No. 419 (R.C.A.F.) Sqn. For citation see Wing Cdr. Pleasance, D.F.C. and Bar.

F/O. A. H. R. ZILLWOOD, R.N.Z.A.F., No. 75 (N.Z.) Sqn. For citation see W/O. Hurse, C.G.M.

Wing Cdr. E. C. HAMBER, R.C.A.F., No. 426 (R.C.A.F.) Sqn.

Sqn. Ldr. R. C. CHOPPING, R.A.F.V.R., No. 514 Sqn.

Flt. Lt. A. J. L. CRAIG, R.A.F.V.R., No. 7 Sqn.

Flt. Lt. T. O. JOHNSTON, R.A.F.V.R., No. 161 Sqn.

Flt. Lt. W. H. SPAFFORD, R.C.A.F., No. 408 (R.C.A.F.) Sqn.

Flt. Lt. A. WILDING, R.A.F.O., No. 138 Sqn.

Flt. Lt. J. R. GORDON - DAVIS, R.A.F.V.R., No. 78 Sqn.

F/O. T. B. BRADLEY, R.A.A.F., No. 75 (N.Z.) Sqn.

F/O. W. J. CAMPBELL, R.C.A.F., No. 408 (R.C.A.F.) Sqn.

F/O. H. EAST, R.A.F.V.R., No. 161 Sqn.

F/O. R. J. HAWORTH, R.C.A.F., No. 429 (R.C.A.F.) Sqn.

F/O. R. H. JAMES, R.C.A.F., No. 434 (R.C.A.F.) Sqn.

F/O. C. H. McKENZIE, R.A.F., No. 44 Sqn.

F/O. G. S. STOUT, R.A.F.V.R., No. 617 Sqn.

P/O. W. C. HOLMES, R.A.F.V.R., No. 149 Sqn.

P/O. R. A. KALLE, R.C.A.F., No. 420 (R.C.A.F.) Sqn.

P/O. G. Y. LEBEL, R.C.A.F., No. 429 (R.C.A.F.) Sqn.

Sqn. Ldr. J. G. LINGARD, R.A.F., No. 143 Sqn.

Flt. Lt. R. A. JOHNSON, R.A.F.V.R., No. 144 Sqn.

Flt. Lt. P. A. POWELL, R.C.A.F., No. 404 (R.C.A.F.) Sqn.

Flt. Lt. A. H. HODSON, R.C.A.F., No. 404 (R.C.A.F.) Sqn.

F/O. J. G. GOW, R.N.Z.A.F., No. 489 (N.Z.) Sqn.

F/O. F. E. SPINK, R.A.F.V.R., No. 489 (N.Z.) Sqn.

Sqn. Ldr. F. BRIERLEY, D.F.M., R.A.F.V.R., No. 55 Sqn.

Flt. Lt. R. A. MOORE, R.A.F.V.R., No. 3 Sqn.

Capt. R. A. LLOYD, attached 655 (A.O.P.) Sqn.

P/O. S. B. FELDMAN, R.A.F.V.R., No. 3 Sqn.

W/O. G. F. BROWN, R.C.A.F., No. 293 Sqn.

Flt. Lt. D. A. A. GRAY, R.A.F.V.R., No. 514 Sqn.

Flt. Lt. E. F. WITTING, R.N.Z.A.F., No. 75 (N.Z.) Sqn.

F/O. A. PROCTOR, R.A.F.V.R., No. 75 (N.Z.) Sqn.

Act. Sqn. Ldr. A. S. CAUNT, R.A.F.V.R., No. 166 Sqn.

Act. Sqn. Ldr. J. COMAR, R.A.F.O., No. 105 Sqn.

Act. Sqn. Ldr. J. N. S. CUMMING, R.A.F., No. 109 Sqn.

Act. Sqn. Ldr. G. W. HARDING, R.A.F., No. 105 Sqn.

Act. Sqn. Ldr. M. M. HENDERSON, R.A.F.V.R., No. 635 Sqn.

Act. Sqn. Ldr. F. J. KELSH, R.A.F.V.R., No. 635 Sqn.

Act. Sqn. Ldr. R. J. KENNEDY, R.A.F.V.R., No. 10 Sqn.

Act. Sqn. Ldr. H. C. LOBB, R.A.F.V.R., No. 635 Sqn.

Act. Sqn. Ldr. A. O. PRICE, R.A.F.V.R., No. 7 Sqn.

Act. Sqn. Ldr. A. W. RAVENHILL, R.A.F.V.R., No. 626 Sqn.

Flt. Lt. E. W. ARNOTT, R.A.F.V.R., No. 109 Sqn.

Flt. Lt. J. BREAKEY, R.A.F.V.R., No. 61 Sqn.

Flt. Lt. P. F. DILLON, R.A.F.V.R., No. 692 Sqn.

Flt. Lt. K. HOWARD, R.A.F.V.R., No. 76 Sqn.

Flt. Lt. J. W. JORDAN, R.A.F.V.R., No. 105 Sqn.

Flt. Lt. T. H. MAKEPEACE, R.A.F.V.R., No. 97 Sqn.

Flt. Lt. F. C. PETTS, R.A.F.O., No. 109 Sqn.

Flt. Lt. W. M. REID, R.A.F.V.R., No. 97 Sqn.

Flt. Lt. R. E. G. WAITE, R.A.F.V.R., No. 550 Sqn.

Flt. Lt. A. J. H. WRIGHT, R.A.F.V.R., No. 626 Sqn.

Act. Flt. Lt. A. J. BURNETT, R.A.F.V.R., No. 109 Sqn.

Act. Flt. Lt. A. J. F. CLARK, R.A.F.V.R., No. 427 (R.C.A.F.) Sqn.

Act. Flt. Lt. E. W. COULSON, R.A.F.V.R., No. 640 Sqn.

Act. Flt. Lt. R. E. CROMPTON BATT, R.A.F.V.R., No. 7 Sqn.

Act. Flt. Lt. D. C. DAVIES, R.A.F.V.R., No. 582 Sqn.

Act. Flt. Lt. A. DRINKALL, R.A.F.V.R., No. 83 Sqn.

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Act. Flt. Lt. R. M. ETCHELLS, R.A.F.V.R., No. 156 Sqn.

Act. Flt. Lt. W. C. FREEMAN, R.A.F.V.R., No. 51 Sqn.

Act. Flt. Lt. A. H. HEBBLETHWAITE, R.A.F.V.R., No. 51 Sqn.

Act. Flt. Lt. J. KIRKPATRICK, R.A.F.V.R., No. 102 Sqn.

Act. Flt. Lt. D. K. NELSON, R.A.F.V.R., No. 7 Sqn.

Act. Flt. Lt. T. B. NISBET, R.A.F.V.R., No. 51 Sqn.

Act. Flt. Lt. D. G. O'DONOVAN ILAND, R.A.F.V.R., No. 100 Sqn.

Act. Flt. Lt. A. V. PATCHETT, R.A.F.V.R., No. 49 Sqn.

Act. Flt. Lt. H. B. PHILLIPS, R.A.F.V.R., No. 626 Sqn.

Act. Flt. Lt. C. W. REEVES, R.A.F.V.R., No. 156 Sqn.

Act. Flt. Lt. J. I. ROGERSON, R.A.F.V.R., No. 97 Sqn.

**CHECK MATES: The only W.A.A.F. aircraft equipment checkers in the Middle East, L.A/CW. I. Donholm (left) and L.A/CW. D. Evans, are seen here working on Hurricanes.**

Act. Flt. Lt. R. P. RUBIE, R.A.F.V.R., No. 431 (R.C.A.F.) Sqn.

Act. Flt. Lt. N. R. STEPHENSON, R.A.F.V.R., No. 44 Sqn.

Act. Flt. Lt. C. N. WAITE, R.A.F.V.R., No. 100 Sqn.

Act. Flt. Lt. E. WILLIAMS, R.A.F.V.R., No. 156 Sqn.

Act. Flt. Lt. L. J. D. WHEBLE, R.A.F.V.R., No. 635 Sqn.

F/O. J. G. ALCOCK, R.A.F.V.R., No. 139 Sqn.

F/O. G. H. BARR, R.A.F.V.R., No. 105 Sqn.

F/O. F. D. BASEBE, R.A.F.V.R., No. 576 Sqn.

F/O. J. B. H. BILLAM, R.A.F.V.R., No. 463 (R.A.A.F.) Sqn.

F/O. K. BOWEN-BRAVERY, R.A.F.V.R., No. 550 Sqn.

F/O. R. BREWER, R.A.F.V.R., No. 90 Sqn.

F/O. E. H. BURGESS, R.A.F.V.R., No. 78 Sqn.

F/O. R. J. BURGESS, R.A.F.V.R., No. 90 Sqn.

F/O. J. S. BUTTON, R.A.F.V.R., No. 139 Sqn.

F/O. S. R. CLARKE, R.A.F., No. 617 Sqn.

F/O. D. J. CLAYTON, R.A.F.V.R., No. 78 Sqn.

F/O. H. M. GEORGE, R.A.F.V.R., No. 76 Sqn.

F/O. G. A. GOOM, R.A.F.V.R., No. 35 Sqn.

F/O. J. T. H. GIDDENS, R.A.F.V.R., No. 207 Sqn.

F/O. R. G. HALES, R.A.F.V.R., No. 158 Sqn.

F/O. R. L. HAMBLIN, R.A.F.V.R., No. 100 Sqn.

F/O. A. H. HAMEL SMITH, R.A.F.V.R., No. 429 Sqn.

F/O. R. H. HARRINGTON, R.A.F.V.R., No. 78 Sqn.

F/O. G. HIGHTON, R.A.F.V.R., No. 192 Sqn.

F/O. H. S. HORSFALL, R.A.F.V.R., No. 102 Sqn.

F/O. R. E. HUGHES, R.A.F.V.R., No. 51 Sqn.

F/O. W. JONES, R.A.F.V.R., No. 105 Sqn.

F/O. G. K. KING, R.A.F.V.R., No. 51 Sqn.

F/O. R. L. C. LASHAM, R.A.F.V.R., No. 97 Sqn.

F/O. W. V. LANE, R.A.F.V.R., No. 434 (R.C.A.F.) Sqn.

F/O. K. R. MAKIN, R.A.F., No. 619 Sqn.

F/O. S. C. MATTHEWS, R.A.F.V.R., No. 9 Sqn.

F/O. J. K. MUNDLE, R.A.F.V.R., No. 76 Sqn.

Flt. Lt. L. C. JACOBE, R.A.A.F., No. 109 Sqn.

Act. Flt. Lt. F. A. BADGERY, R.A.A.F., No. 451 (R.C.A.F.) Sqn.

Act. Flt. Lt. J. A. CAMERON, R.A.A.F., No. 156 Sqn.

Act. Flt. Lt. J. S. A. MARSHALL, R.A.A.F., No. 467 (R.A.A.F.) Sqn.

Act. Flt. Lt. K. SCHULTZ, R.A.A.F., No. 463 (R.A.A.F.) Sqn.

F/O. L. S. AINSWORTH, R.A.A.F., No. 467 (R.A.A.F.) Sqn.

F/O. H. C. J. BENTLEY, R.A.A.F., No. 467 (R.A.A.F.) Sqn.

F/O. L. L. DEED, R.A.A.F., No. 156 Sqn.

F/O. S. L. DENNIS, R.A.A.F., No. 156 Sqn.

F/O. J. HANRAHAN, R.A.A.F., No. 102 Sqn.

F/O. D. L. HARRIS, R.A.A.F., No. 467 (R.A.A.F.) Sqn.

F/O. R. W. JEW, R.A.A.F., No. 207 Sqn.

Act. Wing Cdr. H. R. DOW, R.C.A.F., No. 431 Sqn.

Act. Wing Cdr. F. H. WATKINS, R.C.A.F., No. 434 (R.C.A.F.) Sqn.

Act. Sqn. Ldr. H. A. MORRISON, R.C.A.F., No. 405 (R.C.A.F.) Sqn.

Flt. Lt. A. A. C. HARRIS, R.C.A.F., No. 428 (R.C.A.F.) Sqn.

Act. Flt. Lt. J. A. CRUICKSHANK, R.C.A.F., No. 433 (R.C.A.F.) Sqn.

Act. Flt. Lt. P. V. M. ESCARAVAGE, R.C.A.F., No. 434 (R.C.A.F.) Sqn.

Act. Flt. Lt. R. J. GOERES, R.C.A.F., No. 101 Sqn.

Act. Flt. Lt. J. S. GORDON, R.C.A.F., No. 635 Sqn.

Act. Flt. Lt. F. E. GUILLEVIN, R.C.A.F., No. 431 (R.C.A.F.) Sqn.

Act. Flt. Lt. E. R. HENRY, R.C.A.F., No. 109 Sqn.

Act. Flt. Lt. A. G. McAULEY, R.C.A.F., No. 427 (R.C.A.F.) Sqn.

Act. Flt. Lt. L. W. QUEALE, R.C.A.F., No. 405 (R.C.A.F.) Sqn.

Act. Flt. Lt. R. H. PATTISON, R.C.A.F., No. 109 Sqn.

Act. Flt. Lt. H. H. SMITH, R.C.A.F., No. 452 (R.C.A.F.) Sqn.

Act. Flt. Lt. R. A. SWARTZ, R.C.A.F., No. 405 (R.C.A.F.) Sqn.

F/O. C. G. BALSDON, R.C.A.F., No. 435 (R.C.A.F.) Sqn.

F/O. T. A. CACCHIONI, R.C.A.F., No. 138 Sqn.

F/O. G. F. CARRUTHERS, R.C.A.F., No. 12 Sqn.

F/O. C. J. COMBE, R.C.A.F., No. 424 Sqn.

F/O. R. G. CONRAD, R.C.A.F., No. 166 Sqn.

F/O. G. L. COUTTS, R.C.A.F., No. 424 Sqn.

F/O. A. F. DODDS, R.C.A.F., No. 571 Sqn.

F/O. H. G. S. DUNBAR, R.C.A.F., No. 433 (R.C.A.F.) Sqn.

F/O. R. K. EBSERY, R.C.A.F., No. 207 Sqn.

F/O. R. McL. GIRVAN, R.C.A.F., No. 100 Sqn.

F/O. E. A. GREENWOOD, R.C.A.F., No. 514 Sqn.

F/O. E. O. HALLIKAS, R.C.A.F., No. 83 Sqn.

F/O. H. C. HEANEY, R.C.A.F., No. 514 Sqn.

F/O. F. J. HUNTLEY, R.C.A.F., No. 434 (R.C.A.F.) Sqn.

F/O. E. B. HUTCHINSON, R.C.A.F., No. 425 (R.C.A.F.) Sqn.

F/O. M. J. JOHNSON, R.C.A.F., No. 428 (R.C.A.F.) Sqn.

F/O. K. W. JONES, R.C.A.F., No. 431 Sqn.

Flt. Lt. J. D. HARRIS, R.N.Z.A.F., No. 582 Sqn.

Act. Flt. Lt. W. B. SMAILL, R.N.Z.A.F., No. 7 Sqn.

F/O. W. E. ANDERSON, R.N.Z.A.F., No. 75 (N.Z.) Sqn.

F/O. A. A. DRAY, R.N.Z.A.F., No. 109 Sqn.

### Conspicuous Gallantry Medal (Flying)

W/O. A. W. HURSE, R.A.A.F., No. 75 (N.Z.) Sqn.—This officer and warrant officer were navigator and air bomber respectively of an aircraft detailed to attack a target at Nantes. Shortly after making the attack, the aircraft sustained damage. The pilot was seriously injured and was unable to execute his duties. Despite his lack of experience, W/O. Hurse took over the controls, and with the assistance of F/O. Zillwood succeeded in flying the damaged aircraft to base. These members of aircraft crew displayed exceptional coolness, great determination and devotion to duty in most difficult circumstances. They have completed very many sorties against heavily defended targets in Germany.

### Distinguished Flying Medal

Sgt. G. D. BURTON, R.A.F.V.R., No. 420 (R.C.A.F.) Sqn.

Sgt. J. P. FLORENCE, R.C.A.F., No. 424 (R.C.A.F.) Sqn.

Sgt. J. MANGIONE, R.C.A.F., and Sgt. G. J. McD. RITCHIE, R.C.A.F., both No. 429 (R.C.A.F.) Sqn.

Flt. Sgt. K. VOWE, R.A.F.V.R., No. 61 Sqn.

Sgt. S. BILLINGTON, R.A.F.V.R., No. 61 Sqn.

Sgt. G. J. W. PARKINSON, R.A.F.V.R., No. 43 Sqn.
Sgt. C. J. SYMES, R.A.F.V.R., No. 77 Sqn.
Sgt. H. WIDDUP, R.A.F.V.R., No. 100 Sqn.
Sgt. J. S. WILLIAMS, R.A.F.V.R., No. 106 Sqn.
Sgt. K. WOOLLARD, R.A.F.V.R., No. 44 Sqn.
Sgt. F. W. WRAY, R.A.F.V.R., No. 149 Sqn.
Flt. Sgt. R. J. HOWES, R.A.A.F., No. 218 Sqn.
Flt. Sgt. T. H. N EMERSON, R.C.A.F., No 405 (R.C.A.F.) Sqn.
Flt. Sgt. W. G JACKETT, R A F.V R., No. 35 Sqn. (deceased).
Flt. Sgt. (now P/O.) D. J. MARKS, R.A F.V.R., No. 97 Sqn. (deceased).
Sgt. (now P/O) R. W. BELSHAW, R A F V R , No 214 Sqn. (deceased).
Flt. Sgt. (now Act. W/O.) O. LAMBERT, R.A.F.V.R., No. 97 Sqn. (deceased).
Sgt. S. ROBSON, R.A F.V.R., No. 103 Sqn. (deceased).
Sgt. D. WILLIAMS, R.A.F.V.R., No. 103 Sqn (deceased).
Flt. Sgt. J. J. SHIPLEY, R A F.V.R., No. 9 Sqn.
Flt. Sgt. L. R. HARMAN, R.A.F.V.R., No. 58 Sqn.
Flt. Sgt. E. SALMON, R.A F.V.R., No. 158 Sqn.
Sgt. D. F. WALKER, R.A.F.V.R., No. 427 (R.C.A.F.) Sqn.
Flt. Sgt. A. STANLEY, R.A.F.V.R., No 214 Sqn.
Flt. Sgt. T. STONEBANK, R.A F.V.R., No. 158 Sqn.
Sgt. R. G. BLACKWELL, R.A F.V.R., No 77 Sqn.
Sgt. D. ROGERS, R.A.F.V.R., No. 77 Sqn.
Sgt. S. H. SMITH, R.A.F.V.R., No. 10 Sqn.
Sgt. R. V. FRENCH, R.A.F.V.R., No. 149 Sqn.
Flt. Sgt. H. BECK, R.A.F., No. 10 Sqn.
Flt. Sgt. E. J. DAVIES, R.A.F.V.R., No. 76 Sqn.
Flt. Sgt. J. W. CAMERON, R.A.F.V.R., No. 99 Sqn.
Flt. Sgt. R. J. IRVING, R.A.F.V.R., No. 199 Sqn.
Flt. Sgt. H. N. JOHN, R.A.F.V.R., No. 355 Sqn.
Flt. Sgt. P. KEARNS, R.A.F.V.R., No. 99 Sqn.
Flt. Sgt. P. V. J. LOWEN, R.A.F.V.R., No. 619 Sqn.
Flt. Sgt. J. MCLUSKIE, R.A.F.V.R., No. 166 Sqn.
Flt. Sgt. N. MACHIN, R.A.F.V.R., No. 83 Sqn.
Flt. Sgt. B. A. MANNING, R.A.F.V.R., No. 83 Sqn.
Flt. Sgt. J. H. MURPHY, R.A.F.V.R., No. 75 (N.Z.) Sqn.
Flt. Sgt. L. F. CONDON, R.A.A.F., No 101 Sqn.
Flt. Sgt. (now P/O.) D. W. ALLEN, R.C.A.F., No. 630 Sqn.
Flt. Sgt. A. V. WING, R.C.A.F., No. 463 Sqn.

THE KING has been graciously pleased to approve the following awards in recognition of distinguished services:—

### Military Cross

Flt. Lt. E. E. WILLIAMS, No. 75 (N.Z.) Sqn.
F/O. R. E. JACKSON, R.A.F.V.R.

### Distinguished Conduct Medal

W/O. (now P/O.) C. B. FLOCKHART, R.A.F.V.R., 76 Sqn.

### Military Medal

Cpl. H. BURGESS, Army Air Corps.
Cpl. T. DAVIES, Army Air Corps.

## Foreign Decorations

THE KING has granted unrestricted permission for the wearing of the undermentioned decoration conferred upon the airmen indicated in recognition of valuable services rendered in connection with the war:—

*Conferred by the President of the United States of America*

### Soldiers Medal

Sgt. G. OVEREND, R.A.F. Regt., R.A.F.
L.A/C. F. CATON, R.A.F. Regt., R.A.F.V.R.

## Roll of Honour

*Casualty Communiqué No.* 430.

THE Air Ministry regrets to announce the following casualties on various dates. The next of kin have been informed. Casualties "in action" are due to flying operations against the enemy; "on active service" includes ground casualties due to enemy action, non-operational flying casualties, fatal accidents and natural deaths.

Of the names in this list 75 are second entries giving later information of casualties published in earlier lists.

## Royal Air Force

KILLED IN ACTION.—Sgt. R. P. G. Allen; Sgt. H. Beanland; F/O. P. C. Beloe; Sgt. J. T. G. Catterwell; F/O. A. L. Collingwood, D.F.M.; Sgt. R. C. Downs; Sgt. V. B. Florent; Flt. Lt. G. A. Harrison; F/O. G. S. Holmes; Flt. Sgt. K. Lentin; F/O. D. Lillington; Sgt. R. F. Mitchell; Sgt. J. B. Parkin; Flt. Sgt. F. H. Phillips; Flt. Sgt. B. H. A. Puig; F/O. N. J. Purce; Flt. Sgt. T. W. Rodger; Flt. Lt. A. G. Staffiere; Sgt. E. C. Stilwell.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—F/O. K. T. Every; F/O. P. R. McIntosh.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Sgt. L. Allen; Sgt. F. L. Backhouse; Sgt. R. S. Bayly; Sgt. G. H. B. Bell; F/O. C. J. Bickham; Act. Flt. Lt. C. D. Boothby, D.F.C., D.F.M.; Sgt. D. S. Bratt; F/O. J. A. Brett; Flt. Sgt. R. F. Broad; Sgt. J. G. Clarke; P/O. F. Clayton, D.F.M.; Sgt. G. E. Cleverly; Sgt. W. A. Davis; Sgt. R. P. Dean; Sgt. C. H. Downs; P/O. A. E. Emans; Sgt. A. Girdler; Flt. Sgt. G. H. Gittins; Flt. Sgt. R. L. Graham; Sgt. C. L. Hamilton; P/O. E. B. Harvey; Flt. Sgt. J. Hawkyard; Sgt. O. A. Hayes; Sgt. J. W. Hayton; Flt. Sgt. G. Heath; Sgt. D. S. Hirst; F/O. W. F. John; Sgt. K. Jones; Sgt. P. F. Kille; Sgt. R. E. Langford; Flt. Sgt. W. H. Lowe; Sgt. T. J. Lucy; F/O. G. R. McCleave; F/O. C. P. McManus; Sgt. F. Madden; Flt. Sgt. R. W. Maggs; Sgt. R. C. Mason; Sgt. M. Mensforth; Sgt. R. Nelson; Flt. Sgt. J. P. Nugent; Sgt. D. O'Donoghue; Sgt. H. G. Paskins; F/O. C. J. Payne; F/O. E. A. Pery-Knox-Gore; F/O. B. K. Pelyt; F/O. D. R. Pope; Sgt. H. P. Purdy; Sgt. P. Roberts; Sgt. A. E. Rosen; Sgt. H. A. Saunders; P/O. G. P. Smith; P/O. F. E. Somers; F/O. G. D. Spyers; Flt. Sgt. K. Timms; Sgt. F. Tweedale; Sgt. S. H. Weakner; Flt. Sgt. W. G. Webster; Sgt. L. E. P. Wells; F/O. C. J. M. Wilkie; Sgt. S. Wilkinson; Sgt. H. R. Wynn.

**"DROPPED" TANKS: German long-range drop tanks found on the captured Brussels airfield. These tanks, which carry about 150 gallons of fuel, have been used on the Me 110.**

WOUNDED OR INJURED IN ACTION.—Sgt. A. Bailes; P/O. B. R. Pengilley; Flt. Lt. S. T. Sharpe; Sgt. F. A. Silor.

DIED OF WOUNDS OR INJURIES RECEIVED IN ACTION.—Flt. Sgt. D. J. M. Dunn.

MISSING, BELIEVED KILLED IN ACTION.—Flt. Lt. R. V. Carroll; Flt. Sgt. R. O. Connor; Flt. Sgt. J. W. R. Cox; F/O. J. A. Inglis; Sgt. R. McCafferty; Flt. Lt. R. W. Nesbitt; F/O. R. W. Thomson, D.F.C.; Flt. Sgt. I. F. Wheatley.

MISSING.—F/O. E. Albon; Flt. Sgt. J. W. Angus; Flt. Lt. R. G. Ash; Sgt. W. E. Astley; P/O. W. H. Austin; Sgt. P. H. Baigent; Sgt. A. J. F. Bailey; Sgt. C. A. Balser; W/O. P. E. Bamford; Sgt. S. G. R. Barham; Sgt. D. V. Barlow; Sgt. C. C. Barnes; Sgt. A. C. Barrett; Sgt. J. P. O. Bell; Sgt. G. A. Berry; Sgt. W. McK. Biehl; W/O. T. Birch; Flt. Sgt. L. E. Bliss; Sgt. J. Blyth; Sgt. M. R. Bonser; Sgt. R. J. Bott; F/O. D. A. Burden; Sgt. R. J. Campbell; Sgt. H. Chadwick; Sgt. B. J. Chillingworth; Sgt. E. Clayden; Sgt. W. Cockshott; Sgt. R. C. Collings; Flt. Sgt. D. J. MacC. Currie; Flt. Sgt. R. C. Dale; Sgt. E. G. Davies; Sgt. N. Davies; Sgt. M. F. Dilkes; F/O. M. Dodds; Flt. Sgt. P. H. Douglass; Flt. Lt. J. Downey, D.F.M.; Flt. Sgt. E. A. Durrant; W/O. F. A. Easthope; F/O. J. C. Ellis; Sgt. J. D. Eivin; Sgt. W. English; Sgt. J. R. Fagg; P/O. D. T. G. Fairbairn; Sgt. T. A. Fairhurst; L.A/C. A. H. Fancourt; Sgt. W. Farquharson; A/C.1 J. H. Ferguson; F/O. J. A. Fletcher; Flt. Sgt. F. Foster; F/O. W. A. H. Fountain; Sgt. J. D. Francis; P/O. S. F. Francis; Sgt. J. R. French; Sgt. H. W. Fricker; Sgt. F. W. Fuce; L.A/C. J. Gaughan; Sgt. H. W. Gee; Sgt. S. Gilder; Sgt. J. C. Glancey; Act. Flt. Lt. W. E. Grantham; F/O. C. J. Griffith; Sgt. W. H. Griffiths; Sgt. J. Hancock; Sgt. E. Harrop; F/O. K. C. M. Hayman; Flt. Sgt. F. A. Hayward; Sgt. M. H. Hewes; Sgt. A. C. Hickman; Act. Sqn. Ldr. J. H. Hill; F/O. H. T. Hills; F/O. M. Hills; Flt. Sgt. W. J. Hobbs; Flt. Sgt. J. W. Hobson; Flt. Sgt. L. H. Hood; Flt. Sgt. S. H. Hoy; Sgt. D. G. Hughes; Flt. Sgt. J. C. L. Humphrey; F/O. P. A. C. Hunt; Sgt. B. M. Jacques; Flt. Lt. E. H. Jeffreys, D.F.C.; Sgt. G. A. S. Johnstone; Sgt. J. T. H. Johnstone; P/O. W. Kay; Sgt. P. A. Kemp; Sgt. P. S. Kidd; Sgt. S. E. Lanceley; Sgt. H. J. L. M. Lane; Sgt. N. Lishman; Cpl. G. Logan; Sgt. W. S. McIntosh; Sgt. A. J. MacPherson; Flt. Lt. G. Mains; Sgt. R. S. Millar; Flt. Sgt. J. Miller; Act. F/O. M. N Milner; Sgt. P. E. Mitchell; P/O. D. Moffatt-Wilson; Sgt. K. W. C. Moore; Sgt. T. Moreland; Flt. Sgt. S. E. Morgan; Flt. Lt. P. W. Norbury; Sgt. C. B. Norman; Sgt. F. W. B. Norris; Sgt. A. Orrick; Sgt. E. W. Palmer; Act. Flt. Lt. W. E. Palmer; Sgt. F. H. J. Paul; L.A/C. R. J. Peckham; F/O. A. V. Philp; F/O. H. C. Polkinghorne; Sgt. D. L. Pratt; Sgt. T. B. Preston; W/O. G. Radcliffe; Sgt. T. B. Rees; Flt. Sgt. J. W. Robinson; A/C.1 T. C. Rolt; Sqn. Ldr. W. D. B. Ruth, D.F.C.; Sgt. F. Sedgwick; Sgt. A. J. Sellick; Flt. Sgt. D. Sharland; Flt. Sgt. J. E. Sharpley; Sgt. H. R. Smith; F/O. J. Smith; Sgt. D. E. South; Sgt. H. W. Stow; Sgt. S. J. Thomas; Sgt. A. Thomson; Sgt. E. S. Tickle; Sgt. F. J. Tilbrook; Sgt. E. Topping; F/O. F. Torery; Flt. Sgt. R. Towndrow; Flt. Sgt. H. R. Vaughan; Flt. Sgt. E. Watson; P/O. K. A. Wells; Sgt. A. Wharton; Flt. Sgt. K. E. Wiles; F/O. P. A. Wilson; F/O. G. L. Woolven; Flt. Sgt. T. C. H. Young.

KILLED ON ACTIVE SERVICE.—Sgt. A. J. Allen; Sgt. B. H. Brooks; Sgt. D. Davidson; Flt. Sgt. F. W. Filmer; Sgt. H. C. Finch; W/O. A. G. Gibb; Flt. Sgt. E. P. Graham; P/O. A. P. Harris; F/O. R. F. Huband; Flt. Sgt. P. L. Humphries; Sgt. D. E. W. Jones; Flt. Sgt. R. Lynn; Sgt. J. A. Malcolm; Sgt. G. W. Mosey; Sgt. V. B. Myers; Sgt. D. Park; Sgt. A. Rogers; Sgt. J. J. H. Smith; Flt. Sgt. H. W. Taylor; P/O. R. N. H. Walter; Cpl. G. V. C. Warburton; W/O. D. J. B. White; F/O. H. Wilkes, D.F.M.

WOUNDED OR INJURED ON ACTIVE SERVICE.—L.A/C. K. M. Coel; Flt. Sgt. A. R. Cox; L.A/C. C. J. McGuigan.

DIED OF WOUNDS OR INJURIES RECEIVED ON ACTIVE SERVICE.—Flt. Sgt. R. G. Ambrose.

DIED ON ACTIVE SERVICE.—L.A/C. E. Archer; L.A/C. N. Brocklehurst; Cpl. R. E. S. Butler; Cpl. J. Clarke; W/O. W. Harvey; Cpl. H. F. Hoare; A/C.1 W. J. Hosking; L.A/C. J. Laytham; L.A/C. H. G. Thomas; Act. Cpl. H. L. T. Waugh; L.A/C. H. Wright.

PREVIOUSLY REPORTED MISSING, NOW REPORTED PRISONER OF WAR.—Flt. Sgt. K. J. Davis; Flt. Lt. N. R. Watts.

## Woman's Auxiliary Air Force

DIED ON ACTIVE SERVICE.—A/CW.1 E. M. Dickens; L.A/CW. A. A. M. Reeves.

## Royal Australian Air Force

KILLED IN ACTION.—W/O. C. M. Wood; W/O. J. L. Warne; P/O. F. L. Symons; P/O. G. D. Jekyll.

WOUNDED OR INJURED IN ACTION.—W/O. R. D. Ward.

DIED OF WOUNDS OR INJURIES RECEIVED IN ACTION.—Flt. Sgt. F. P. Adams.

MISSING, BELIEVED KILLED IN ACTION.—Flt. Lt. H. L. Smith.

MISSING.—Act. Flt. Lt. W. Dobson; W/O. R. B. Flegg; P/O. J. J. Fletcher; P/O. R. L. Giles; Flt. Sgt. M. F. J. McNamara; Flt. Sgt. H. McRostie; Flt. Sgt. P. A. Robson; Flt. Sgt. R. P. Singleton; Flt. Sgt. J. Turner.

## Royal Canadian Air Force

KILLED IN ACTION.—Sgt. A. L. George; P/O. J. E. K. Hannesson; F/O. V. P. Hillrich; Flt. Sgt. A. Pawliuk.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Flt. Sgt. W. E. Ackland; Flt. Sgt. W. H. Burton; Flt. Sgt. G. T. Hooper; F/O. W. S. Sewall; Flt. Sgt. J. A. Smart; Sgt. A. W. L. Worrad.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Flt. Sgt. A. J. Cadeau; F/O. R. P. Goldstein; Sgt. G. M. Herbert; Sgt. J. Lundy.

DIED OF WOUNDS OR INJURIES RECEIVED IN ACTION.—F/O. G. Dumville.

MISSING, BELIEVED KILLED IN ACTION.—F/O. M. L. Cameron; Flt. Lt. R. L. Sutherland.

MISSING.—P/O. H. Beazley; Sgt. E. Carter-

# SERVICE AVIATION

Edwards; P/O. R. D. Davidson; F/O. R. N. Elwin; F/O. D. J. Evans; Flt. Sgt. F. H. Fulsher; Flt. Sgt. G. E. Hitchcock; F/O. G. F. Hutchinson; Flt. Sgt. S. F. H. Kelley; P/O. L. D. Kidd; W/O. A. A. McCaig; W/O. W. McClelland; P/O. M. McLear; Sgt. H. L. F. Moller; Sgt. G. F. Jr. Murphy; Sgt. R. M. Pitts; Sgt. W. R. White; P/O. E. D. Woods.

## *Royal New Zealand Air Force*

KILLED IN ACTION.—Flt. Sgt. R. J. Harris.

WOUNDED OR INJURED IN ACTION.—Flt. Sgt. G. E. Brancher.

MISSING, BELIEVED KILLED IN ACTION.—Flt. Sgt. J. J. McLean.

MISSING.—Flt. Lt. C. A. Armstrong, D.F.M.; W/O. W. Brothers; P/O. C. C. W. Gover; F/O. G. E. S. McNaughton; F/O. A. A. Matheson, D.F.M.; Act. Wing Cdr. S. D. Watts, D.S.O., D.F.C.

## *South African Air Force*

KILLED IN ACTION.—Lt. R. A. Cumming.

### *Casualty Communiqué No. 431*

Of the names in this list 73 are second entries giving later information of casualties published in earlier lists.

## *Royal Air Force*

KILLED IN ACTION.—L.A/C. G. T. Atkinson; Sgt. E. H. J. Bashford; Sgt. C. A. R. Dummer; Sgt. C. R. B. Lewington; Sgt. R. F. Pearce.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Sgt. A. H. Bale; W/O. R. B. B. Billows; Sgt. R. D. Britton; Sgt. J. H. F. Cochrane; Sgt. R. G. Craig; F/O. S. B. Cuthbert; Sgt. G. W. Hewitt; Sgt. H. Revell; Sgt. R. V. D. Smith; F/O. J. V. Tyler.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—P/O. C. T. Anderson; Flt. Sgt. D. W. Anderson; Sgt. W. A. Beales; F/O. J. R. H. Bell; F/O. W. Birdsall; Sgt. P. McL. Birt; Sgt. G. Bown; F/O. K. R. Burbeck; Sgt. R. A. Chumbley; Sgt. R. E. Clark; Sgt. C. E. Crisp; Sgt. E. J. Deaves; Flt. Sgt. B. P. Devine; Sgt. H. D. Evans; Sgt. W. F. Garner; P/O. J. H. Gillmore; Flt. Sgt. P. V. Gone; Flt. Sgt. R. V. Gough; Sgt. J. J. Grange; F/O. A. Grant, D.F.C.; Sgt. M. Griffiths; Sgt. C. T. Harston; Sgt. V. Hirst-Gee; Sgt. J. S. Hornsby; F/O. R. Lofthouse; Sgt. E. Magson; Sgt. W. B. Marchant; Flt. Sgt. D. M. Menzies; Sgt. H. Milner; Sgt. W. A. Morton; Sgt. J. O'Leary; P/O. F. E. S. Parker; F/O. V. C. Peters; Flt. Sgt. J. McK. Prentice; Sgt. P. S. Raddall; Sgt. J. M. Shand; Sgt. W. H. Spiers; Sgt. B. J. Thomas; F/O. P. Thompson; Sgt. R. K. Triggol; Flt. Sgt. W. Walker; Flt. Sgt. V. A. Weaver; Sgt. I. G. Williams; Sgt. A. E. Woodacre.

DIED OF WOUNDS OR INJURIES RECEIVED IN ACTION.—Flt. Lt. M. J. W. Benn, D.F.C.

MISSING, BELIEVED KILLED IN ACTION.—Sgt. S. Alldis; Flt. Sgt. F. E. Baker; Sgt. K. R. Baker; Sgt. J. E. Bawtree; Sgt. H. Bradbury; Sgt. R. Bramley; P/O. J. Bray; Sgt. L. A. Brotherton; Sgt. J. B. Carter; Sgt. R. A. Crawford; Flt. Sgt. A. F. W. Farley; Sgt. P. Gaines; F/O. W. G. Grant; F/O. P. H. Greenburgh; F/O. A. B. Leonard; Sgt. W. J. McCarroll; F/O. M. A. Monks; F/O. A. Oakes; Sgt. S. W. Peake; Sgt. P. F. G. Pearsall; Flt. Sgt. A. J. Read; F/O. J. B. Reynolds; Sgt. I. M. Ross; Act. Sqn. Ldr. W. G. Shadforth, D.F.C.; Sgt. L. T. V. Suffield; P/O. N. Varley; Sgt. A. J. Veale, D.F.M.; Sgt. A. R. Williams; F/O. R. H. Wilton.

MISSING.—F/O. P. L. Andrewes; F/O. R. Armstrong; Flt. Lt. A. S. H. Baillie; Sgt. R. C. Barber; Sgt. J. F. Bleach; Sgt. A. J. Brazier; Sgt. G. K. Brown; P/O. G. C. Buglass; Sgt. R. D. Burns; Sgt. L. M. Byrne; Sgt. W. H. Carr; Flt. Sgt. S. E. W. Cass; Sgt. C. O. Channing; Flt. Sgt. H. J. Chester; F/O. C. C. Chitty; Sgt. K. Clough; Sgt. J. P. Coogan; Act. Flt. Lt. R. E. Cook; Flt. Sgt. S. F. Cooper; F/O. W. M. Crumbley; Sgt. M. Dea; Sgt. G. R. Deeley; Sgt. J. N. D. Dewar; Flt. Sgt. L. Dixon; P/O. D. A. Duncliffe; Flt. Sgt. J. J. Fernandez; Act. Sqn. Ldr. D. R. Fisher, D.F.C., D.F.M.; Act. Sqn. Ldr. R. H. Fokes, D.F.C., D.F.M.; W/O. J. A. Foubister; Sgt. M. F. George; Flt. Sgt. K. G. E. Graves; F/O. J. G. Gray; Flt. Sgt. R. T. Green; Sgt. T. Gribbon; F/O. R. L. Griffin; Flt. Lt. D. H. Griffiths; Flt. Lt. A. J. Hancock, D.F.C.; F/O. N. R. Henderson; Act. Sqn. Ldr. M. J. Herrick, D.F.C.; Flt. Sgt. R. H. Heydon; Sgt. R. A. Hollocks; W/O. G. B. James; Sgt. A. Jenkins; F/O. D. F. W. Keyte; P/O. J. S. Kirton; P/O. G. C. Lawrence; Sgt. F. M. Leaney; Flt. Sgt. G. F. Lewis; Sgt. D. Lloyd; Sgt. C. McLean; P/O. A. Mabon; Flt. Sgt. W. S. Marchant; Flt. Sgt. J. Milne; P/O. C. Newton; F/O. C. W. Nuttall; Sgt. D. W. O'Dell; F/O. W. Oxley; Sgt. P. J. Parker; Flt. Sgt. R. Parkyn; Sgt. W. Patterson; Flt. Sgt. R. W. Peel; Sgt. H. J. Plant; W/O. E. W. Preston; P/O. W. C. Reed; W/O. F. J. Reid; Sgt. J. B. Reid; P/O. W. Renton; Flt. Lt. P. D. L. Roper; Sgt. H. Rothwell; P/O. A. P. Rudland; P/O. A. G. Scott; Sgt. H. D. Scott; Sgt. L. Segaloff; P/O. J. A. Simcox; F/O. J. M. Simpson; W/O. F. T. Softley; Sgt. F. I. Spencer; Sgt. P. Stamper; Flt. Sgt. L. A. Starr; Sgt. W. E. Steger; Flt. Sgt. G. Titman; Sgt. E. O. Walker; Sgt. W. Wallinger; W/O. J. Walmsley; F/O. L. A. Watts; Sgt. R. W. T. Weir, D.F.M.; F/O. H. G. Whitley; P/O. O. L. C. Whittingham; Sgt. E. C. Wicks; P/O. A. Williams; Sgt. B. D. Wilson-Law.

MISSING, BELIEVED KILLED ON ACTIVE SERVICE.—Sgt. R. A. Fuller; Flt. Sgt. N. W. Thomson.

KILLED ON ACTIVE SERVICE.—W/O. C. T. Abel; Sgt. J. W. Argent; Sgt. T. W. Bettridge; Cpl. J. B. Bone; Sgt. J. McD. Chambers; L.A/C. A. F. Cotton; F/O. R. A. Dawson; P/O. E. V. Dunk; Cpl. J. A. Forknall; Sgt. R. L. Ganderton; Sgt. J. Greenan; P/O. J. E. Gunning; P/O. C. J. Higgins; W/O. T. A. Hindmarsh; Flt. Sgt. R. J. Hodgson; Sgt. R. C. Hutchinson; L.A/C. F. Jeffs; Sgt. E. R. Laughton; Flt. Sgt. F. V. McFarlane; Flt. Sgt. F. A. Martin; Cpl. E. F. Middleton; L.A/C. J. Mills; P/O. E. L. Overton; Sgt. J. F. Potts; Sgt. C. Quanborough; F/O. C. S. Ronayne; Sgt. A. W. Sorrie; Cpl. A. W. J. Spacey; Flt. Sgt. T. W. Spark; Sgt. J. Stabler; Sgt. F. Still; W/O. R. D. Stow; F/O. H. K. Thompson; Sgt. A. R. Thomson; Sgt. R. H. Turrell; Sgt. A. Williams.

WOUNDED OR INJURED ON ACTIVE SERVICE.—Sgt. E. E. Allen; Cpl. J. E. Ford; W/O. S. F. G. Walker.

DIED OF WOUNDS OR INJURIES RECEIVED ON ACTIVE SERVICE.—Sgt. J. Totten; Flt. Sgt. R. L. Wade; L.A/C. W. Withnell.

DIED ON ACTIVE SERVICE.—A/C.1 S. Aldridge; L.A/C. F. Baines; A/C.1 L. R. F. Brown; L.A/C. L. Coulbeck; L.A/C. J. S. Cunningham; Flt. Sgt. W. C. G. Dakin; Sgt. A. F. Daniels; A/C.1 R. Foster; Cpl. C. Hanna; Sgt. A. S. Jones; A/C.1 L. E. Leyburn; Cpl. W. McCaffrey; Cpl. R. McLaren; A/C.1 W. B. Mears; A/C.1 A. C. E. Merington; Cpl. H. H. Porteous; Sgt. F. J. Reed; A/C.2 A. Riddell; L.A/C. M. A. Robinson; L.A/C. J. H. State; Cpl. F. C. W. Sweetser; L.A/C. C. Thompson; L.A/C. R. E. Townley; P/O. E. F. S. Travis; A/C.1 A. J. Wilkins.

PREVIOUSLY REPORTED MISSING, NOW REPORTED PRISONER OF WAR.—F/O. H. W. Bacon.

## *Royal Australian Air Force*

KILLED IN ACTION.—P/O. N. C. C. Leitch.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—F/O. E. F. McEgan; Flt. Sgt. F. A. Williams.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—F/O. W. Austin; Flt. Sgt. D. Livingstone; Flt. Sgt. A. J. Pepperrell; P/O. J. H. Short; Flt. Sgt. H. J. Simpson; Flt. Sgt. D. S. Thomas.

MISSING, BELIEVED KILLED IN ACTION.—F/O. N. W. B. Brady; F/O. H. A. Brown; W/O. H. J. Deester; P/O. T. W. Henderson; Flt. Sgt. J. G. Lane; F/O. K. J. Moses; Flt. Sgt. C. S. D. Tainsh; F/O. G. C. Townend.

MISSING.—F/O. L. C. Dadds; F/O. H. W. Davies; Flt. Sgt. J. L. Glanfield; F/O. S. E. Gough; Flt. Sgt. R. P. P. Holden; Flt. Sgt. L. T. Hunt; Flt. Sgt. T. S. Jones; Flt. Sgt. R. J. W. Moore; F/O. W. F. H. Rattle; F/O. J. H. Stopp; F/O. W. R. Tanner.

KILLED ON ACTIVE SERVICE.—F/O. W. G. A. Miller; F/O. W. J. White.

**TITO'S SPITS: Spitfire Vs. of an all-Jugoslav squadron of the Balkan Air Force being serviced on an airfield in Italy. The marking on the fuselage consists of Marshal Tito's red star over R.A.F. roundels.**

## *Royal Canadian Air Force*

KILLED IN ACTION.—W/O. D. R. Graham; W/O. C. D. Leitch.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—P/O. P. J. H. McManus.

WOUNDED OR INJURED IN ACTION.—F/O. H. F. Grimble; Flt. Lt. P. Wilson.

MISSING, BELIEVED KILLED IN ACTION.—Flt. Sgt. D. E. Jones; W/O. H. F. Murphy; P/O. R. D. Ochsner; Flt. Sgt. T. W. Tuttle.

MISSING.—Sgt. N. W. Amstein; Sgt. D. J. Applin; P/O. J. A. Bergeron; Flt. Lt. F. T. S. Brice; Sgt. G. W. Carruthers; F/O. I. B. Croll; P/O. R. O. Ellis; F/O. R. A. L. Forbes; F/O. A. Glendenning; P/O. J. D. Hayes; F/O. J. I. J. Keenan; Cpl. M. F. Kimmerly; F/O. W. M. Lacey; Sgt. M. R. Larkin; F/O. E. R. Lowe; F/O. M. J. McDonald; F/O. D. W. MacFarlane; Sgt. L. W. J. McKenna; F/O. G. E. Mallory; F/O. A. V. Maxwell; P/O. A. J. Retter; F/O. W. J. H. Rushforth; Flt. Lt. M. E. Slaughter; Sgt. E. G. Smith; L.A/C. N. Somolenko; Sqn. Ldr. W. B. Stewart; F/O. A. G. Striowski; P/O. E. G. Todd; F/O. H. A. Wickens; W/O. H. W. Wilson.

MISSING, BELIEVED KILLED ON ACTIVE SERVICE.—F/O. J. M. Rickard.

KILLED ON ACTIVE SERVICE.—F/O. P. H. Duval; Flt. Sgt. J. E. Ford; F/O. D. R. Gilchrist; Sgt. A. K. Hrycenko; Sgt. O. W. Libby; P/O. D. A. McFadyen; Sgt. H. W. R. Tufts; F/O. R. R. F. Whitby; W/O. F. H. T. Whittard; F/O. J. St. C. Wootton.

## *Royal New Zealand Air Force*

WOUNDED OR INJURED IN ACTION.—F/O. C. W. McCardle.

MISSING, BELIEVED KILLED IN ACTION.—P/O. T. W. Boyce; F/O. I. W. Entwistle.

MISSING.—F/O. L. V. Davidson; Flt. Lt. J. E. Jenkinson; F/O. J. L. Lochhead; Flt. Lt. A. M. McLeod; F/O. S. Phillips.

KILLED ON ACTIVE SERVICE.—P/O. R. Newman.

## *South African Air Force*

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Lt. A. E. Cheesman; Lt. R. L. Cherrington; Capt. C. E. Martin; 2/Lt. A. G. Turner.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Lt. M. E. Bagg; Lt. H. F. Boyer; Lt. I. H. Lawrie; Lt. R. W. Passmore; Capt. E. A. Rorvik; Maj. E. C. Saville, D.F.C.

KILLED ON ACTIVE SERVICE.—Lt. D. O. Kilse.